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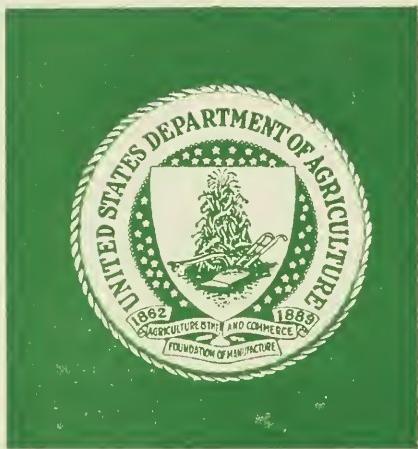
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COMMITTEE PRINT

2001
WATERSHED WORK PLAN FOR DEEP RED RUN-COFFIN
CREEK WATERSHED, TILMAN, KIOWA, AND COMMANCE
COUNTIES, OKLAHOMA //

2021
REPORT OF THE SOIL CONSERVATION SERVICE, DEPARTMENT
OF AGRICULTURE, IN ACCORDANCE WITH THE
PROVISIONS OF PUBLIC LAW 83-566 //

COMMITTEE ON PUBLIC WORKS
UNITED STATES SENATE

APRIL 1971

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LETTER OF SUBMITTAL

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 15, 1971

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C. 20510

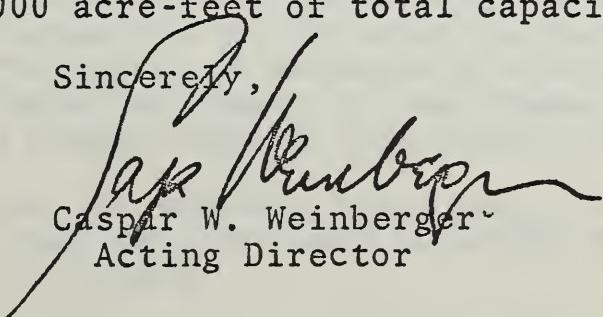
Dear Mr. President:

Pursuant to the authority vested in the President by section 5 of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1005), and delegated to the Director of the Office of Management and Budget by Executive Order No. 10654 of January 20, 1956, there are transmitted herewith the following plans for works of improvement which have been prepared under the provisions of that Act:

<u>State</u>	<u>Watershed</u>
Georgia	Cedar Creek*
Illinois	Lower McKee Creek*
Illinois	Upper McKee Creek*
Kansas	West Sector
North Dakota	Whitewater River*
Oklahoma	Middle South Branch
Tennessee	Forest River
West Virginia	(Supplemental)*
	Deep Red Run-Coffin Creek
	Little Bigby Creek*
	Mill Creek*

Each of the above listed plans involves at least one structure which provides more than 4,000 acre-feet of total capacity.

Sincerely,


Caspar W. Weinberger
Acting Director

Note: Referred to the Committee on Public Works by the Secretary of the Senate on April 19, 1971, Executive Communication No. 32.

*Printed separately.

ENVIRONMENTAL STATEMENT

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Prepared in Accordance with Section 102(2)(C) of P. L. 91-190

Date: January 1971

Title of Statement: The Effect of the Upstream Watershed Project for Deep Red Run-Coffin Creek Watershed, Oklahoma, Upon Environmental Quality.

Authority for Project: Public Law 566, 83rd Congress, 68 Stat. 666, as amended.

Sponsoring Local Organizations: Tillman County, Kiowa County and Comanche County Soil and Water Conservation Districts and the City of Frederick

Nature of Action:

The following statement presents information for a watershed project on Deep Red Run-Coffin Creek Watershed, located northeast of Frederick, in northern Tillman County, southern Kiowa County, and southwestern Comanche County, Oklahoma. Plans for solving water and related natural resource problems have been prepared by the above-listed sponsors with Federal assistance under provisions of Public Law 83-566. The sponsoring local organizations assume all local responsibilities for the installation, operation and maintenance of planned structural works.

The watershed covers an area of 58,600 acres with 72 percent used for pasture and range, 25 percent for cropland and about 3 percent for miscellaneous uses. There are 132 farm units in the watershed. Livestock production and the growing of wheat and cotton are the primary sources of income. The average size farm is about 450 acres and the average annual gross income about \$11,000. Approximately 100 of these farm units covering 64 percent of the watershed have soil and water conservation plans.

The 573-acre flood plain of the watershed is subject to frequent flooding, with severe floods occurring on an average of more than once each year. Erosion is moderate throughout the area with rates averaging about 1.3 acre-feet per square mile annually. Approximately 240 acres of the flood plain have been damaged by sediment deposition and 100 acres have been damaged by the scouring action of floodwater. An estimated 40 acre-feet of sediment from this watershed is deposited annually in Lake Texoma, a Corps of Engineers' project. Flood damages amount to about \$46,000 annually.

There is a critical need for municipal and industrial water supply for the City of Frederick. There is also a need for water areas to satisfy the water based recreational demands in the region.

Habitat for mourning dove, quail, squirrel, rabbit, prairie dog, hawk and songbirds is of moderate value. Some turkey and deer are found in the lower

portion of the watershed. The only available fishery is farm ponds, scattered throughout the area. Streams are intermittent and do not support a fishery habitat.

The project provides for conservation land treatment on about 17,000 acres to be applied during the 5-year project installation period. The project also includes two multiple-purpose reservoirs with storage capacity for floodwater, sediment, municipal and industrial water supply, and public recreation with associated recreational facilities.

All construction areas will be revegetated with appropriate grasses and woody plantings to control erosion after construction. These areas are now being used for pasture and range with some areas of cropland. Vegetative plantings will be made within the 880-acre fenced area surrounding the reservoirs. The plantings will be selected from grass and shrub species that have value for wildlife food and cover.

Contractors will be required to adhere to strict guidelines for minimizing soil erosion and water and air pollution during construction. To aid in giving proper attention to health protection, the following Public Health Service Publications will be used as guidelines in the design and installation of watershed features: Public Health Service Drinking Water Standards (PHS Publication No. 956), Manual for Evaluating Public Drinking Water Supplies (PHS Publication No. 1820), Environmental Health Practices in Recreational Areas (PHS Publication 1195) and Prevention and Control of Vector Problems Associated with Water Resources (PHS Monograph, January 1965).

An archeological survey of the watershed has not been made. The National Park Service, however, has indicated that significant archeological remains within the project area are probable. The Soil Conservation Service will keep the National Park Service informed of the progress of the project so that archeological surveys and any necessary salvage can be carried out prior to the beginning of construction.

Statement:

(i.) Environmental Impact

Conservation land treatment will reduce erosion and sediment production by about 25 percent. The combination of land treatment and structural measures will reduce average annual sediment damages by about 88 percent and floodwater and scour damages by about 98 percent. The sediment entering Lake Texoma from this watershed will be reduced by about 85 percent, to about 6 acre-feet annually.

It is estimated that about 125 farms will experience a reduction of flood damages by structural measures installed in this project.

The storage of water will furnish a supplemental municipal and industrial water supply for the City of Frederick. It will meet the quality standards of the Oklahoma Department of Health. This is expected to lead to continued population growth, expansion of existing industries and attraction of new industries to the community. It will also relieve the pressure on use of the diminishing ground water supply and conserve more of this water for other uses.

The impoundments will create about 1,210 acres of water surface and inundate about 8 miles of intermittent stream channels. The installation of public recreational facilities is expected to attract about 87,000 visitors annually. The new lake surface areas will provide feeding and resting areas for migratory waterfowl.

(ii.) Favorable Environmental Impact

1. Reduce erosion and sediment production by about 25 percent.
2. Reduce sediment damages to flood plain lands by about 88 percent.
3. Reduce floodwater damages by about 98 percent.
4. Reduce sediment transported to Lake Texoma from 40 acre-feet to about 6 acre-feet annually.
5. Provide opportunity for recreational use in an area where such opportunity is now limited or non-existent. An estimated 87,000 people will use the facilities each year.
6. Provide 10,300 acre-feet of storage capacity to supplement the water supply for the City of Frederick.
7. Create an additional 1,210 acres of water surface that can be used as a lake fishery, and waterfowl resting and feeding areas.

(iii.) Adverse Environmental Effects Which Cannot be Avoided

1. Construction of dams, spillways, pool areas and recreation facility areas will destroy or disturb the vegetative cover on approximately 1,500 acres.
2. Agricultural production will be lost on these 1,500 acres and the adjacent 2,570 acres to be developed for recreation. These areas are now used for pasture, rangeland and a few cultivated fields.
3. Wildlife habitat will be lost permanently on 1,200 acres and lost on an additional 300 acres until shrubs and grasses are seeded around the lakes after construction.
4. There will be about 8 miles of intermittent stream channels inundated by the impoundments.

(iv.) Alternatives to the Proposed Action

One alternative to the planned action is one of no project. This would alleviate the loss of wildlife habitat to be sustained by project installation, but allow for the continued degradation of natural resources by erosion, sediment deposition in channels and downstream reservoirs, and flooding along streams. It would also allow the rapid depletion of the limited ground water supply. In addition, the monetary benefits foregone by not implementing the project would be about \$370,000 each year.

The Bureau of Reclamation's authorized Mountain Park Reservoir near Snyder, Oklahoma, provides an alternative source of water supply for Frederick. The cost for delivering the water 14 miles via pipeline proved to be more expensive than providing water supply capacity in the proposed project. Furthermore, water from the Mountain Park Reservoir would not be available for several years. Since the need for water in Frederick is immediate, plans were formulated to add water supply storage capacity to the two floodwater retarding structures. The City of Frederick intends to use the Mountain Park Project for its future needs.

(v.) Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

Most of the land in the watershed is primarily devoted to agricultural production and is not expected to change. The

project will reduce erosion, flooding and sedimentation and will provide a supplemental water supply and recreational opportunity for the immediate and more distant future. Current productivity will be maintained and improved. Even after the designed life of the project of 100 years, the project will still be effective in conserving the land and water resources of the watershed.

(vi.) Irreversible and Irretrievable Commitments of Resources

The local sponsors will purchase and fence 3,077 acres, including the two multiple-purpose pools. The project will commit about 3,100 acres now used for agriculture (crop, pasture, and range) to the following nonagriculture uses: (1) 1,200 acres in lakes, (2) 1,000 in flood pools, and (3) 900 acres for recreational facilities including about 350 acres for access roads.

No other permanent commitment of resource is known to be required for this project.

Consultation - General

The application for assistance for the Deep Red Run-Coffin Creek Watershed project was submitted to and approved by the Oklahoma State Soil Conservation Board. The plan for solving water and related land resource problems was developed in full consultation with Federal, State and local agencies. Coordination meetings were held and contacts made during work plan development. Prior to preparation of the final plan, an informal field review was held in the watershed at which time interests were invited to present their views and recommendations either orally or in writing. The plan and environmental statement have been prepared in consideration of such comments and recommendations as were provided by reviewing Federal agencies and the Governor of Oklahoma.

Consultation with Appropriate Federal Agencies

The Department of the Interior suggested that there should be some description of the expected future quality of water.

The analysis of water samples by the City of Frederick's consultants indicates that the water quality will meet the standards of the Oklahoma Department of Health in every detail. The maintenance of the water quality throughout the life of this project will depend upon State and local enforcement of water quality standards and other sanitary regulations. At the present time there is nothing to indicate that the quality of water cannot be maintained.

The Department of the Interior recommended the adoption of items 4, 6, 7 and 8 of the Bureau of Sport Fisheries and Wildlife report of September 4, 1970, to alleviate the losses of wildlife habitat incurred through construction of the project. Pages 17, 18 and 24 of the work plan contain provisions to comply with these recommendations. The plan does not mention development of habitat specifically for mourning doves as recommended in Item 4. However, it does provide for vegetative measures including establishment of selected plant species of high values for food, cover and nesting to mitigate losses of habitat in the construction of the impoundments. During installation of vegetative measures for wildlife habitat, specific attention will be given to the needs for mourning dove habitat.

The Department of the Interior also expressed concern about the probable existence of archeological remains in the project area. The Soil Conservation Service has agreed to keep the Director, Southwest Region, National Park Service, informed of the progress of the project so that archeological surveys and any necessary salvage may be carried out prior to the beginning of construction activities. The environmental statement has been revised to reflect this.

The Department of the Interior also stated that the City of Frederick will participate in the Bureau of Reclamation's authorized Mountain Park project, and that the environmental statement should reflect this fact. It also recommended that the environmental statement should be corrected to reflect that about 1,200 acres of wildlife habitat will be permanently lost through inundation. This has been done.

The Department of Health, Education and Welfare recommended that appropriate health guidelines outlined in the following publications be employed during development and operation of the project:

For municipal drinking water (source and distribution) - The Public Health Service Drinking Water Standards (Public Health Service Publication number 956) and the Manual for Evaluating Public Drinking Water Supplies (Public Health Service Publication number 1820).

For recreational areas -
Environmental Health Practices in Recreational Areas (Public Health Service Publication number 1195).

For control of disease vector problems -
Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

The environmental statement has been revised to show that these guidelines will be followed.

Review by State and Local Agencies Developing and Enforcing Environmental Standards:

No problems or objections were presented.

APPROVED BY

Kenneth E. Grant
Administrator

DATE JAN 28 1971

COMMENTS OF THE STATE OF OKLAHOMA



STATE OF OKLAHOMA
OFFICE OF THE GOVERNOR

OKLAHOMA CITY

DEWEY F. BARTLETT
GOVERNOR

December 2, 1970

Mr. Kenneth E. Grant, Administrator
Soil Conservation Service
United States Department of Agriculture
Washington, D. C. 20250

Dear Mr. Grant:

This office has received for review the work plan for watershed protection, flood prevention, municipal water supply, and recreational development of Deep Red Run-Coffin Creek Watershed, Tillman, Kiowa, and Comanche Counties, Oklahoma.

The plan has been reviewed by the Water Resources Board, the Department of Health, the Department of Agriculture, the Department of Wildlife Conservation, and the Industrial Development and Park Department, who concur in general with the plan. The Department of Highways indicated there were interference problems with a Federal aid secondary road, however, they stated this could be worked out and they concurred with the remainder of the plan.

This office, therefore, approves this work plan, which provides a critical needed water supply for municipal and industrial uses for the City of Frederick as well as flood control and recreation benefits, as proposed and will cooperate in the development of this plan.

Sincerely,

A handwritten signature in black ink that reads "Dewey F. Bartlett".
DEWEY F. BARTLETT
GOVERNOR

COMMENTS OF THE DEPARTMENT OF THE ARMY



DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

November 24, 1970

Honorable Thomas K. Cowden
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Dr. Cowden:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Administrator of the Soil Conservation Service, by letter of 9 October 1970, requested the views of the Secretary of the Army on the work plan for Deep Red Run - Coffin Creek Watershed, Tillman, Kiowa and Comanche Counties, Oklahoma.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert E. Jordan, III".

Robert E. Jordan, III
Special Assistant to the Secretary of the Army
(Civil Functions)



COMMENTS OF THE DEPARTMENT OF THE INTERIOR

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

December 11, 1970

Dear Mr. Secretary:

This is in reply to the letter of October 15, 1970, from the Administrator of Soil Conservation Service, submitting for our review and comment the work plan for Deep Red Run-Coffin Creek Watershed, Oklahoma. In accordance with Section 2 of Executive Order 10913 and provisions of Section 5 of the Watershed Protection and Flood Prevention Act, as amended, this work plan has been reviewed by interested agencies of the Department of the Interior and the following comments are offered.

We note that there are no municipal or industrial waste discharges to the watershed. While the work plan describes the quality of runoff water as excellent "mineral quality", we feel that there should be some description of the expected future quality of water stored for municipal supply. We believe that every report proposing water resource development should address the subject of water quality in some detail.

To protect water quality during the construction period, we recommend that contract specifications require all contractors to adhere to guidelines for minimizing soil erosion and air pollution during construction as set forth in Soil Conservation Service "Engineering Memorandum-66".

We recommend the adoption of Recommendations 4, 6, 7, and 8 in the Bureau of Sport Fisheries and Wildlife report of September 4, 1970, to alleviate the losses of wildlife habitat incurred through construction of the project. It is also requested that a copy of the enclosed report accompany the work plan when it is forwarded to the Congress.

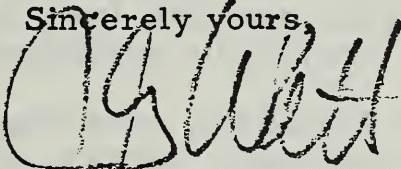
While the watershed has not been surveyed archeologically, there is a high degree of probability that significant archeological remains exist within the project area, therefore, we request that the Director, Southwest Region, National Park Service, Department of the Interior, Box 728, Santa Fe, New Mexico 87501, be kept informed of the progress of this proposal so that an archeological survey and any necessary salvage can be programmed and completed prior to the beginning of project construction. Should the parties to the Work Plan Agreement desire to initiate an archeological survey of the project area, the National Park Service can arrange such a survey on a reimbursable basis with a cooperating institution.

The environmental statement should indicate the probable existence of archeological values and the action proposed to survey and salvage such values.

Item III of the statement, Alternatives to the Proposed Action, states that Mountain Park Reservoir was considered as an alternate source of water for the City of Frederick. The reservoir is a feature of Reclamation's authorized Mountain Park Project. In September 1969 Frederick residents approved the sale of \$2.4 million in bonds to help toward financing of reservoirs on Deep Red Run and Coffin Creek as an immediate source of supply. In an election on October 6, 1970, the electorate gave its approval by a margin of 4 to 1 for the city to participate in the Mountain Park Project. The project would yield a long-term water supply. This alternative should be reflected in the environmental statement.

The environmental statement in Section II on page 4 states that "the construction of the dams, spillways and appurtenant items . . . will disturb some vegetative cover and temporarily reduce available cover for wildlife on approximately 1,500 acres." The second sentence in Section III also indicates that there would be only a temporary and minor loss of wildlife habitat to be sustained by project installations. We suggest these statements be corrected to reflect that about 1,200 acres of wildlife habitat will be permanently lost through inundation.

We appreciate the opportunity to review and comment on this watershed work plan, and provided that the above recommendations are considered, we have no objections to the proposed project.

Sincerely yours,


Deputy Assistant Secretary of the Interior

Honorable Clifford M. Hardin
Secretary of Agriculture
Washington, D.C. 20550

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

January 6, 1971

Mr. Kenneth E. Grant
Administrator
Soil Conservation Service
Department of Agriculture
Washington, D.C. 20250

Dear Mr. Grant:

As requested in your letter of October 15, 1970, the work plan and draft environmental statement for the proposed Deep Red Run - Coffin Creek Watershed project have been reviewed by appropriate agencies of the Department that have an environmental interest.

The work plan describes a proposed multiple-purpose water resource development for watershed protection, flood control, municipal and industrial water supply and recreation for the Deep Red Run - Coffin Creek Watershed located in southwest Oklahoma.

Our review indicates that the project as proposed will have no significant adverse effect on environmental matters of concern to the Department of Health, Education, and Welfare if adequate health protection measures are provided for during post-authorization planning.

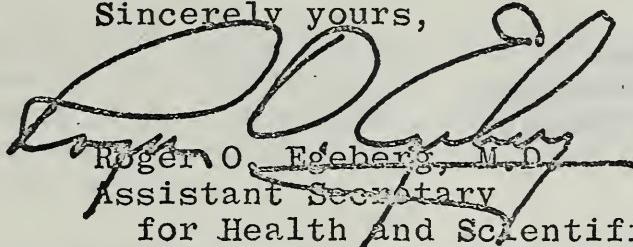
To insure proper attention to health protection with regard to this proposal, we recommend that appropriate health guidelines outlined in the following publications be employed during the development and operation of the project:

1. For municipal drinking water (source and distribution): The Public Health Service Drinking Water Standards (Public Health Service publication number 956) and the Manual for Evaluating Public Drinking Water Supplies (Public Health Service publication number 1820).

2. For recreational areas: Environmental Health Practices in Recreational Areas (Public Health Service publication number 1195).

3. For control of disease vector problems: Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

Sincerely yours,



Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

COMMENTS OF THE DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Washington, D. C. 20250

January 11, 1971

Honorable J. G. Watt
Deputy Assistant Secretary
Department of the Interior

Dear Mr. Watt:

This is in reply to your letter of December 11, containing the comments of the Department of the Interior on the work plan for Deep Red Run-Coffin Creek Watershed, Oklahoma.

The second paragraph of your letter suggests that the work plan include, in some detail, a description of the expected future quality of water stored for municipal supply. The analysis of water samples by the City of Frederick's consultants, as described on page 45, indicates that the water will meet the standards of the Oklahoma Department of Health in every detail. The maintenance of the water quality throughout the life of this project will, of course, depend upon State and local enforcement of water quality standards and other sanitary regulations.

We feel that the degree of detail in the work plan concerning water quality should be generally proportionate to the existence of water quality hazards or problems. In the absence of any present or foreseeable future hazards, it appears that the detail provided in this plan may be appropriate. In other cases where it is evident that water quality would be in serious jeopardy unless corrective measures are taken, the plan should present more detail as you suggest. In any event, the results of water quality analyses are available in the supporting data for the project even though they may not be included in the plan.

You recommended the adoption of Items 4, 6, 7 and 8 in the Bureau of Sport Fisheries and Wildlife report of September 4, 1970, to alleviate the losses of wildlife habitat incurred through construction of the project. It is the intent of provisions on pages 17, 18 and 24 of the work plan to comply with these recommendations. The plan does not mention development of habitat specifically for mourning doves as recommended in Item 4. However, it does provide for vegetative measures including establishment of selected plant species of high values for food, cover and nesting to mitigate losses of habitat in the construction of the impoundments. During installation of vegetative measures for wildlife habitat, specific attention will be given to the needs for mourning dove habitat.

Regarding your comment about the probable existence of archeological remains within the project area, we will keep the Director, Southwest Region, Nation Park Service, informed of the progress of the project so that archeological surveys and any necessary salvage can be carried out prior to the beginning of construction activities. Mention of these probable values and notification provisions will be included in the environmental statement.

As you suggest, we will also revise the environmental statement to (1) recognize the amount of wildlife habitat which will be permanently lost from inundation in project reservoirs; and (2) reflect that the City of Frederick expects to obtain a long-term water supply from the Mountain Park Reservoir Project.

Thank you for calling these matters to our attention and for the opportunity to provide this explanation.

Sincerely,



Kenneth E. Gant

Administrator

WATERSHED WORK PLAN AGREEMENT

between the

TILLMAN COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

KIOWA COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

COMANCHE COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

CITY OF FREDERICK
Local Organization

State of Oklahoma
(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Deep Red Run-Coffin Creek Watershed, State of Oklahoma, under the authority of the Water-shed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Deep Red Run-Coffin Creek Watershed, State of Oklahoma, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about 5 years.

It is mutually agreed that in installing and in operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. Except as hereinafter provided, the Sponsoring Local Organization will acquire without cost to the Federal Government such land rights as will be needed in connection with the works of improvement (estimated cost \$841,600). The percentages of this cost to be borne by the Sponsoring Local Organization and the Service from P. L. 566 funds are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization (percent)</u>	<u>Service (percent)</u>	<u>Estimated Land Rights Cost (dollars)</u>
<u>Multipurpose Structure No. 1 and Recreational Facilities</u>			
Payment to Landowners for about 2,568 acres	61.62	38.38	513,600
Cost of Relocation or Modification of Improvements*	61.62	38.38	15,000
Flowage Easements (190 acres)	100.00	-	9,500
Legal Fees, Surveys, and Other Costs	100.00	-	10,000
<u>Multipurpose Structure No. 2</u>			
Payment to Landowners for about 820 acres (\$164,000), Flowage Easements, 90 acres (\$4,500), Road Relocation (\$115,000),* and Legal Fees \$10,000)	100.00	-	293,500

*Including necessary engineering services, construction, and additional land costs.

The Sponsoring Local Organization agrees that all land acquired or improved with P. L. 566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
<u>Multipurpose Structure No. 1</u>			
Structure	35.65	64.35	614,090
Municipal Outlet	100.00	-	65,000
Recreational Facilities	50.00	50.00	229,856

Multipurpose Structure No. 2

Structure	27.89	72.11	424,672
Municipal Outlet	100.00	-	60,000

4. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
<u>Multipurpose Structure No. 1</u>			
Structure	33.20	66.80	54,226
Municipal Outlet	100.00	-	4,420
Recreational Facilities	50.00 <u>1/</u>	50.00 <u>2/</u>	22,986

Multipurpose Structure No. 2

Structure	27.89	72.11	40,552
Municipal Outlet	100.00	-	3,045

5. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$19,608 and \$284,402 respectively.

- 1/ The Sponsoring Local Organization will work with the Service in developing an overall layout for placement of the basic facilities and will develop detailed designs for all facilities.
- 2/ The Service will assist in developing overall layout for basic facilities, and will check and approve detailed designs of facilities. The cost of services provided will not exceed the value of those provided by the Sponsoring Local Organization.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.
13. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

15. With respect to construction inspection, the Service will, at PL-566 cost, provide construction inspection for all structural works of improvement on which PL-566 construction funds are spent. It will also inspect all other features of project installation where malfunction or failure could adversely affect the stability or functioning of cost-shared items of work. Service inspection of local cost items is solely for this purpose and does not relieve the sponsors of the responsibility for providing, without PL-566 cost sharing, construction inspection necessary to assure that the installation conforms with contract requirements.

In connection with construction inspection, sponsors will, without PL-566 cost sharing, provide such service for the installation of the 100 percent local cost items of work. They may, at their own option and without PL-566 cost sharing, inspect the installation of any portion of works of improvement.

TILLMAN COUNTY SOIL AND WATER CONSERVATION DISTRICT

Local Organization

By

Richard M. Mota

Title

Chairman of Board

Date

September 3, 1970

The signing of this agreement was authorized by a resolution of the governing body of the Tillman County Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 3, 1970

Conrad Stoll

(Secretary, Local Organization)

Date

Sept. 10 1970

KIOWA COUNTY SOIL AND WATER CONSERVATION DISTRICT

Local Organization

By

J. Bryan Gentry

Title

Chairman

Date

Sept. 14, 1970

The signing of this agreement was authorized by a resolution of the governing body of the Kiowa County Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 14, 1970

Lorraine L. S.

(Secretary, Local Organization)

Date

Sept 14 - 1970

COMANCHE COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

By Harry J. Daum
Title Chairman

Date 9-15-70

The signing of this agreement was authorized by a resolution of the governing body of the Comanche County Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 1, 1970

Elliott Welsh
(Secretary, Local Organization)

Date 9-15-70

CITY OF FREDERICK
Local Organization

By John Stasy
Title Mayor

Date 9-14-70

The signing of this agreement was authorized by a resolution of the governing body of the City of Frederick

Local Organization

adopted at a meeting held on 9-8-70

Eldon S. Boyd
(Secretary, Local Organization)

Date 9-14-70

Soil Conservation Service
United States Department of Agriculture

By _____

Date _____

WATERSHED WORK PLAN
DEEP RED RUN-COFFIN CREEK
WATERSHED
TILMAN, KIOWA, AND COMMANCHE COUNTIES, OKLAHOMA

WORK PLAN
FOR
WATERSHED PROTECTION, FLOOD PREVENTION,
MUNICIPAL WATER SUPPLY, AND RECREATIONAL DEVELOPMENT

DEEP RED RUN-COFFIN CREEK WATERSHED
Tillman, Kiowa, and Comanche Counties, Oklahoma

Prepared Under the Authority of the
Watershed Protection and Flood Prevention Act
(Public Law 566, 83rd Congress, 68 Stat. 666),
As Amended

Prepared By

Tillman County Soil and Water Conservation District
(Sponsor)

Kiowa County Soil and Water Conservation District
(Sponsor)

Comanche County Soil and Water Conservation District
(Sponsor)

City of Frederick
(Sponsor)

With Assistance By

U. S. Department of Agriculture
Soil Conservation Service

September 1970

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WORK PLAN

DEEP RED RUN-COFFIN CREEK WATERSHED Tillman, Kiowa, and Comanche Counties, Oklahoma

September 1970

SUMMARY OF PLAN

General Summary

The work plan for watershed protection, flood prevention, municipal water supply, and recreational development for the Deep Red Run-Coffin Creek Watershed, Oklahoma, was prepared by the Tillman County, Kiowa County, and Comanche County Soil and Water Conservation Districts and the City of Frederick as the Sponsoring Local Organization. Technical assistance was provided by the Soil Conservation Service of the U. S. Department of Agriculture.

Deep Red Run Creek rises about 10 miles northeast of Snyder and flows in a southerly direction through the watershed. The watershed covers 91.56 square miles, or 58,600 acres, in Tillman, Kiowa, and Comanche counties, Oklahoma. Approximately 25 percent of the watershed is in cropland, 72 percent is in pasture and rangeland, and 3 percent is in miscellaneous uses, such as roads, farmsteads, and stream channels. There are no lands under the jurisdiction of the Bureau of Indian Affairs. The privately owned land on which the structural measures are to be installed will be purchased by the City of Frederick.

The flood plain of this creek and its tributaries (573 acres) is subject to frequent flooding, with large severe floods occurring on an average of more than one per year. The cumulative acreage inundated by the flood events which occur during an average year is 182. The estimated average annual damages approach \$46,000.

There is a critical need for municipal and industrial water supply and an immediate need for water supply to satisfy recreational demands in this area.

The work plan proposes a 5-year period for installing the needed works of improvement at a total estimated cost of \$3,076,457. The share of this cost to be borne by Public Law 566 funds is \$1,388,563, and the value of the local contribution will be \$1,687,894. Average annual damages within the watershed will be reduced about 98 percent by the installed project.

Land Treatment Measures

Land treatment measures will be installed by landowners and operators on 3,600 acres of cropland, 12,800 acres of grassland, and 640 acres of wildlife and recreational areas during the 5-year project installation period. These measures are those necessary to establish good land cover and soil conditions which will decrease erosion damage and sediment yields from cultivated fields and grassland.

The Public Law 566 share of the cost of land treatment measures, which consists entirely of accelerated technical assistance, is \$8,000. The local share of the cost of these measures is estimated to be \$404,000. This cost includes expected reimbursement from the Agricultural Conservation Program, the cost of other going programs, and the value of land treatment measures which will be installed by landowners and operators. Land treatment provided in recent years by local interests has cost an estimated \$487,386.

Structural Measures

The structural measures included in the plan consist of two multi-purpose structures with flood prevention, municipal water supply, water resource improvement, and a recreational development.

The total cost of the structural measures is estimated to be \$ 2,664,457, of which the value of local contribution is \$1,283,894 and the Public Law cost is \$1,380,563. The value of the local share of the cost of structural measures includes construction cost, \$577,292; engineering cost, \$48,271; project administration cost, \$19,608; and land rights, \$638,723.

Damages and Benefits

The average annual floodwater damage in the watershed under nonproject conditions is estimated to be \$2,300, crop and pasture; \$2,717, other agricultural; \$29,703, nonagricultural. After installation of the project, these damages are expected to be reduced to \$35, \$17, and \$46, respectively.

Average annual scour damage will be reduced from \$4,171 to \$83. Damage from overbank deposition of sediment will be reduced from \$2,163 to \$262 annually by the completed project.

Indirect damage (interrupted travel, halting of mail and school bus service, etc.) will be reduced from \$176 to \$55 annually.

Total average annual flood damages for the watershed will be reduced from \$45,937 to \$605, a reduction of 98 percent.

There are 573 acres of flood plain in the watershed for which flood reduction benefits were claimed. Approximately 25 landowners in the

flood plain will receive direct benefits from the works of improvement. All residents of the watershed and surrounding territory will receive indirect benefits from increased income stemming from the project.

The average annual primary and secondary benefits accruing to structural measures are estimated to be \$546,441, distributed as follows:

Damage Reduction	\$ 43,065
Incidental Recreation	9,343
Recreation	110,352
Municipal Water	294,364
Secondary	89,317

The ratio of average annual benefits (\$546,441) accruing to structural measures to the average annual cost of structural measures (\$178,259) is 3.1:1.

Provisions for Financing

The City of Frederick will provide the local installation cost of multipurpose structures 1 and 2 and the associated recreational development through revenue bonds, grants, and donations.

Operation and Maintenance

Land treatment measures will be maintained by the landowners or operators of the farm on which these measures are installed, under agreements with the Tillman, Kiowa, and Comanche County Soil and Water Conservation Districts. The City of Frederick will operate and maintain multipurpose structures 1 and 2 and the recreational development. City funds, supplemented by fees for the use of recreational facilities, will be used for operation, maintenance and for replacement of facilities. The estimated average annual value of operation and maintenance of structural measures is \$40,800. Of this amount, \$40,000 is for operation and maintenance of recreational development associated with site 1.



DESCRIPTION OF THE WATERSHED

Physical Data

Deep Red Run-Coffin Creek Watershed with an area of 58,600 acres (91.56 square miles) is located in southwest Oklahoma. This area includes 31,000 acres in northern Tillman County, 26,500 acres in southern Kiowa County, and 1,100 in southwestern Comanche County. Deep Red Run Creek heads 10 miles northeast of Snyder, Oklahoma and flows in a southerly direction through the watershed. Coffin Creek is the principal tributary. The drainage area of these creeks forms a crescent-shaped watershed, with a length of 23 miles and a maximum width of 7 miles, with the lower end at the confluence of Deep Red Run and Deadman creeks.

There are no towns located in the watershed. Frederick is about 8 miles southwest and Snyder about 1 mile west of the boundaries.

The topography is gently rolling over most of the area. Surface elevations range from 1,100 feet above mean sea level on the flood plain at the lower end of the watershed to around 1,600 feet in the upper reaches.

The major portion of Deep Red Run-Coffin Creek Watershed lies on the Wichita Formation. Small remnants of the Wichita Mountains are exposed in the upper end of the watershed. Minor Terrace deposits are located on the west edge of the watershed as well as along the stream channels.

The Wichita Formation of Permian Age consists in this area of red shale with some gray medium-textured sandstone beds. The Post Oak conglomerate member contains weathered granite debris from the Wichita Mountains.

The Wichita Mountain remnants are Pre-Cambrian reddish granite that rise above the surrounding area. The Terrace deposits belong to the Quaternary system and consist of unconsolidated gravels, sand, silt, and clay.

The watershed is located in the Red Bed Plains Physiographic Region and Central Rolling Red Plains Land Resource Area. The major soils in the watershed are Asa, Clairemont, Foard, Indiahoma, Miller, Tillman, and Vernon series. Asa and Clairemont soils are deep, loamy, moderately permeable soils on flood plains. Miller soils are deep, clayey, very slowly permeable soils on flood plains. Foard and Tillman soils are deep, loamy, very permeable soils with clayey

subsoils on uplands. Most of the Asa, Miller, Foard, and Tillman soils are used for cultivation. Most of the Clairemont soils are used for pasture and most of the Indiana and Vernon soils are used for range.

The following table lists the land use and is based on detailed sedimentation surveys over 80 percent of the area:

<u>Land Use</u>	<u>Acre</u>	<u>Percent</u>
Cropland	14,570	25
Pasture and Rangeland	42,230	72
Miscellaneous ^{1/}	1,800	3
	58,600	100

1/ Includes roads, farmsteads, stream channels, special treatment areas, etc.

The watershed is near the eastern edge of the Southern Great Plains. The area is provided a warm, continental climate of generally mild winters and long, hot summers. Major weather disturbances develop over the area when the prevailing warm, moisture-laden air arriving from the Gulf of Mexico conflicts with the cool and drier air arriving from the west coast and Canada.

The annual rainfall at Frederick is 26.41 inches. The seasonal distribution is as follows: 15 percent in winter, 35 percent in spring, 27 percent in summer, and 23 percent in the fall.

The average annual temperature at Frederick is 63.9 degrees Fahrenheit. The highest and lowest temperatures recorded at Frederick were 117 degrees Fahrenheit above zero and 8 degrees Fahrenheit below zero, respectively. The growing season is approximately 224 days in length, extending from the latter part of March to the first of November.

Water for domestic and urban uses is obtained principally from farm ponds and wells. Most of the wells produce water of suitable quality. The overall amount of water available from all sources is limited during periods of extended drought.

Economic Data

The Deep Red Run Creek drainage area is located in Tillman, Kiowa, and Comanche counties. However, all the direct benefits from municipal and flood storage will accrue in Tillman County. Therefore, the following data will describe conditions in Tillman County as representative of the watershed.

The economy of the watershed is dependent primarily on agriculture and agriculturally-oriented industries. Most firms are engaged in servicing agriculture and in handling, processing, and transporting agricultural products. In addition to these, there are unrelated industries (such as leather goods, textile, granite, automotive parts) located within the county and provides employment for approximately 700 people. These industries provide off-farm employment for many farmers and their families and help provide a balance to the economy, which has reversed the loss in population trend.

According to the U. S. Census, total population of Tillman County has decreased from 20,754 in 1940 to 17,598 in 1950 to 14,654 in 1960 to 12,877 in 1970. The rural portion of the population shows a loss from 15,645 in 1940 to 12,131 in 1950 to 8,775 in 1960, while Frederick shows a gain from 5,109 in 1940 to 5,467 in 1950 to 5,879 in 1960. These trends indicate a migration of population from the county as well as a slight shift from rural to urban living.

The population projection for the county is 17,500 for 1980 and 22,500 for 1990. These projections were made by the Tillman County Comprehensive Planning Commission in 1969.

The 1959 census report shows the average size farm in Tillman County as 445.8 acres, with an average value for land and buildings of \$64,999. Average annual gross income per farm for the county approximates \$11,250. Median family income for the county in 1959 was \$3,330. These figures are representative of the watershed.

The major agricultural enterprise is cash crops, with these being wheat, cotton, alfalfa, and grain sorghums. The other major source of agricultural income is livestock, principally beef cattle. Approximately 80 percent of the farm income is from the sale of crops and 20 percent is from the sale of livestock and livestock products.

Wheat occupies about 54 percent and cotton 23 percent of the cultivated areas. Together they produce about 60 percent of the total farm income. Fluctuations in the price of these crops have a tremendous effect on the watershed's economy. Of the two crops, wheat has been the mainstay. Total acres have been determined by allotment programs and demand for wheat. Yields have risen steadily with variety improvements, better implements, and fertilizer. Cotton also is a very important cash crop. This crop has rivaled wheat and has had a greater influence on the local economy. The production, harvesting, and processing of the crop involves more people and firms for a longer period of time.

In recent years an interest in feedlot operations has developed in the county. A number of commercial feedlots have developed, with carrying capacity exceeding 20,000 cattle. These feedlots are located near Frederick, outside the drainage area of the watershed.

Towns in the area, such as Frederick, Manitou, Hollister, Loveland, Snyder, and Tipton, serve as trading centers and market places for agricultural products. These towns are principal sources of equipment, fuel, insecticides, and other items needed for the production of crops and livestock for the watershed and surrounding area. Although many farmers live on their farms, others live in these towns and use them as a center for their farming operations.

The watershed is served by U. S. Highways 183 and 62, State Highway 5, an all-weather, farm-to-market road, and several miles of unimproved county roads. Rail transportation needs are met by the St. Louis-San Francisco Railroad, with connections at Frederick, and the MKT, which runs southeast by northwest connecting Frederick and Grandfield. Freight in the area consists mostly of agricultural and petroleum products.

Land Treatment Data

The soil and water conservation program authorized by Public Law 46 furnishes technical assistance to three soil and water conservation districts in the watershed. The supervisors of these districts have actively promoted conservation in all aspects and have used their influence to arouse interest in watershed programs on the part of farmers, ranchers, and other interested groups.

There are about 132 farm units in the watershed. These units are furnished assistance in the planning and application of soil and water conservation measures by the Soil Conservation Service work units at Frederick, Hobart, and Lawton.

These work units have assisted farmers and ranchers by the preparation of 100 soil and water conservation plans on 37,760 acres (approximately 64 percent of the total area of 58,600 acres).

Fish and Wildlife Resource Data

This watershed is composed of 58,600 acres (14,570 acres cultivated cropland, 42,230 acres rangeland, and 1,800 acres miscellaneous). Cultivated crops are wheat, cotton, alfalfa and grain sorghums. Rangeland of the watershed is typical of the Central Rolling Red Plains Land Resource Area. There is a fair to good cover of grasses such as mesquite, buffalo grass, side-oats grama, blue grama, and little blue stem on the upland range sites. This is all open country with occasional patches of mesquite and pricklypear invading the rangeland.

Along the streams where the bottomland soils are deeper and more fertile with a higher water table, the vegetative cover consists of mid grasses and some woody cover that is typically small and scrubby.

Elm, hackberry, pecan, chittom, soapberry, ash, mesquite, gray stem dogwood and cottonwood are common varieties of woody plants found in these narrow bands along the streams. In the upper reaches of the streams where the flood plains are narrow and where alluvial soils are more shallow, there is less brush and woody plants growing along the stream banks.

Wildlife species found in the watershed include mourning dove, quail, squirrel, rabbit, prairie dogs, hawks and song birds. Some turkey and deer are found in the lower portion of the watershed that provides suitable habitat.

Many of the farm ponds in the watershed are stocked with fish and provide good fishing. Because of the low annual rainfall, that portion of Deep Red Run Creek and its tributaries that drains this watershed, is intermittent.

WATERSHED PROBLEMS

Floodwater Damage

It is estimated that, with average antecedent moisture conditions, a 24-hour, 100-year frequency storm would produce 5.5 inches of runoff and inundate 573 acres of bottomland (excluding channel) below the site locations. This is an area of first bottom, varying in width from 200 to 300 feet on each side of a channel that is 80 to 100 feet wide and 10 to 15 feet deep.

Immediately above this first bottom lies a second bottom that is flat and extends as much as 1,000 feet on each side of the first bottom. This area could be flooded by something greater than a 100-year frequency storm.

Floodwater damages above the confluence of Deep Red Run-Coffin Creek are minor. Major damages begin to occur below this point. This area is inundated one to two times per year.

The 25-year frequency, 24-hour duration runoff would inundate 490 acres, or approximately 86 percent of the 573 acres. A 5-year frequency runoff would inundate 284 acres (49 percent). The 2-year frequency storm would inundate 164 acres (29 percent), while a 1-year storm runoff would cover 4 percent of the flood plain. The average annual flooding for future conditions without project would be approximately 182 acres.

Assuming average antecedent moisture conditions, it is estimated the peak discharge at valley section 2 (Figure 1) from a 24-hour, 100-year frequency runoff would be 11,900 c.f.s.; 25-year frequency runoff, 8,600 c.f.s.; and 5-year frequency runoff, 5,000 c.f.s.; 2-year frequency runoff, 3,000 c.f.s.; 1-year frequency runoff, 1,660 c.f.s.

For purposes of evaluation, the flood plain of Deep Red Run and Coffin Creeks was considered as one reach.

Reach 1 (573 acres) includes the area upstream from the confluence of Deadman Creek to the dam sites just above the baseline road.

The flood plain inundated by the 100-year frequency storm (573 acres) consists almost entirely of the first bottom. This area is characterized by rather rough and uneven bottomlands that flood frequently. The soils for the most part are deep, fertile, mixed alluvial soils that are highly productive. They are not used very intensively because of the uneven topography and frequency of flooding. Approximately 37 percent of the area is used to produce wheat and alfalfa and approximately 50 percent is in improved pastures. The lower 10 percent of the flood plain is in pecan orchards. Land in this area

is valued from \$300 to \$500 per acre. The gross damageable value per acre of crops and pasture, using projected land use, yields, and prices, is \$85.75.

The estimated replacement value of bridges and their approaches that could be destroyed by a 100-year frequency storm is \$150,000. The estimated replacement value of fences in the flood plain area is \$9,000.

The meandering course of the channel involves numerous bridges and low water crossings on county roads. The confined first bottom flood plain results in deep floodwater flows at excessive velocities, causing extensive damage to these crossings and creating hazardous travel conditions.

All fence crossings and water gaps are washed away with each high flow.

The total direct floodwater and associated damages without the project are calculated to be \$41,761 annually, divided as follows: crop and pasture, \$2,300; other agricultural, \$2,717; nonagricultural, \$29,703; overbank deposition, \$2,163; sediment to Texoma, \$707; flood plain scour damage \$4,171.

Indirect damages, such as interruption of travel, detours, extra travel for school bus and main routes, loss in condition of livestock, extra expense of feed to replace pasture, and similar losses are \$4,176.

Sediment Damage

Damages by sediment deposition on the flood plain range from slight to moderate. A total of 239 acres has been damaged by deposits of sediment ranging from fine texture sand to silty clay. Estimated damages are from 10 percent to 40 percent in terms of reduced productive capacity. At present there are 128 acres damaged 10 percent, 61 acres damaged 20 percent; 39 acres damaged 30 percent; and 11 acres damaged 40 percent.

It is estimated that 39.1 acre-feet of sediment are being delivered annually to Lake Texoma Reservoir under present watershed conditions.

Erosion Damage

Sheet erosion is the major source of gross erosion in the watershed. The amounts of gross erosion by sources are: sheet erosion, 77 percent; streambank erosion, 7 percent; gully erosion, 8 percent; road erosion, 7 percent; and flood plain scour, 1 percent. The average annual rate of gross erosion is 1.35 acre-feet per square mile.

Destruction of vegetative cover by fire has been a minor problem. Educational programs emphasizing the detrimental effects of burning now being carried on by the Extension Service and local soil and water conservation districts have been effective in preventing fires.

Scouring action of flood flows has damaged 106 acres of flood plain land; 77 acres, 10 percent; 22 acres, 20 percent; and 7 acres, 30 percent. These percentages of damage reflect the estimated reduction in productivity.

Problems Relating to Water Management

Drainage: Natural drainage of the flood plain lands on Deep Red Run Creek is adequate in most cases. Problems of drainage can be remediated by on-farm drainage measures since suitable outlets are available.

Irrigation: Farmers in this area have been irrigating from wells drilled in the Tillman County Terrace for several years. The number of wells has increased from 80 in 1952 to over 500 in 1967. There are no irrigation wells in the watershed, however, and surface sources for water supplies for this purpose are inadequate.

Municipal and Industrial Water: The source of water supply, since 1917, for the City of Frederick is from wells drilled in the Tillman County Terrace. The wells owned by the city are competing with irrigation wells for water from this aquifer.

In the appraisal of ground water supplies made by the Oklahoma Water Resources Board, it was determined that the continued development of large capacity wells at the present rate will cause widespread decline of water levels and the mining of water. The safe yield for this ground water source was estimated at slightly more than 100 g.p.m. per square mile. This area has been declared critical as a source of ground water.

Inadequate water supply has limited the industrial growth of Frederick. Existing industries in the area have the facilities for adding more than 200 additional employees upon the realization of an assured water supply. Rationing of water by the city is commonplace during summer months. Irrigators have an injunction against the city to prohibit drilling additional wells, and two damage suits have been decided in favor of landowners. Litigation over withdrawal of ground water further compounds the city problem relating to water management.

Recreation: There are few water impoundments in this area for recreational use. The nearest lakes of any size to this vicinity are Lugert to the west and lakes in the Lawton area to the northeast. The need for water-oriented recreational opportunities continues to increase because of more leisure time, increased incomes, and improved means of transportation.

Fish and Wildlife: Streamflow in this area is intermittent due to low rainfall. Since these streams dry up, fishing opportunities are nonexistent. Farm ponds usually furnish a dependable water supply for fish and wildlife; however, during drought periods many ponds become dry. Some ponds have been stocked with fish, but most of them need more intensive management.

PROJECTS OF OTHER AGENCIES

The proposed Mountain Park dam and reservoir, a USDI Bureau of Reclamation project, is located on Otter Creek about 6 miles north of Snyder, Oklahoma. This program includes a low water dam and a diversionary canal to take water out of Elk Creek. The project has been authorized for construction by Congress. The Mountain Park reservoir is about 28 miles north of Frederick, Oklahoma.

Lake Texoma, a multipurpose reservoir on Red River, located at the junction of the Washita and Red rivers, is about 150 miles southeast of this watershed. The project constructed by the Corps of Engineers was completed in 1942. The Deep Red Run-Coffin Creek project will reduce the volume of sediment now being delivered to the Red River and Lake Texoma from this watershed.

PROJECT FORMULATION

The need for flood protection to the agricultural flood plain land on Deep Red Run and its tributaries and the need for the storage of water supplies for beneficial uses for the community were recognized by the local sponsoring organizations. Flood problems, watershed protection, land treatment, and water management needs have been examined by the local sponsors, other interested groups, and the Soil Conservation Service. The objectives initially agreed upon as a basis for project formulation include the following:

1. Develop conservation plans on at least 80 percent of the farms and ranches in the watershed. These plans will encourage landowners and operators to use the land within its capabilities and to carry out treatment according to its needs for protection and improvement of the soil resources. Those measures applied at an accelerated rate will be effective in reducing soil erosion, improving fertility, and increasing the productivity of cropland and grassland. Land treatment also will have a significant effect in reducing floodwater and sediment damages on flood plain lands.

The application of a conservation and land treatment program will increase farm income and result in a better standard of living for farm families.

2. Plan a system of waterflow control measures with sufficient floodwater storage to supplement these land treatment measures and provide a reduction in average annual floodwater and associated damage by at least 80 percent.
3. Provide sufficient storage in proposed structures to meet present and future demands for municipal and industrial water supplies for the community. The City of Frederick will employ professional engineers to determine present and future needs and to furnish evidence that these measures will provide the optimum solution to the city's water supply problems.
4. Provide measures for water-related recreational needs of the area. Included will be a water resource improvement, the creation or improvement of the surrounding area for water-oriented outdoor recreation, and the installation of the facilities needed for public use and access.
5. Provide a habitat condition which will preserve, improve and perpetuate wildlife resources. Include mitigating measures to compensate for the loss of wildlife habitat to the extent comparable in degree to that adversely

affected by the construction of the proposed multiple purpose structures.

6. Result in a watershed which will be an outstanding example of soil and water conservation.

The project is needed to reduce the loss of agricultural land by erosion; enhance the value of the land by increasing the productivity and by making possible more efficient farming; provide a habitat and conditions which will preserve, improve, and perpetuate fish and wildlife; reduce floodwater damages; and advance the welfare of land-owners and operators in the watershed.

The size and location of the structural measures were influenced by the level of protection needed to meet project goals and the storage requirement of water for beneficial uses. Selection of these measures was based on the least costly system to meet project objectives.

The need for watershed protection and flood prevention on areas downstream from the watershed was recognized by the local sponsoring organizations. The urgency to develop a watershed work plan that would include a water supply for the community in the shortest possible time precluded adding other areas downstream to the watershed area.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program is necessary for a sound watershed protection and flood prevention program on the watershed. The basic objectives of the conservation program are the use of each acre of agricultural land within its capabilities and the establishment and maintenance of soil and water conservation practices essential to proper land use. Land treatment measures already installed (Table 1A) indicate that landowners and operators are now using soil and water conservation and plant management practices in their farming operations. The Tillman County, Kiowa County, and the Comanche County Soil and Water Conservation Districts have agreed to accelerate the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment, and scour damages.

Land treatment for the drainage area above the multipurpose structures (48,320 acres) is important for protection of the watershed. This land treatment will allow the structures to function more efficiently by reducing the sediment delivered to the sites. Effective treatment of the watershed area below these structures on 9,280 acres will be important in reducing flood plain scour damages and in maintaining high levels of agricultural productivity.

Land treatment measures will be installed by landowners and operators of the watershed lands during a 5-year project installation period. An estimate of the acres to be treated and the cost of the treatment are given in Table 1. They comprise, primarily, the measures to establish good land cover and soil conditions which will decrease erosion damage and sediment yields from cultivated fields and pastures.

Cropland treatment includes conservation cropping systems, cover and green manure crops, and improved tillage to attain crop residue use for protection and conditioning. Supplementary to these soil-improving practices are contour farming, terracing, diversions, and grassed waterways.

Pasture and rangeland treatment measures include: Pasture planting and range seeding to establish good cover on lands formerly cultivated and on rangeland with poor cover, proper use of pasture and rangeland, and construction of farm ponds to provide sufficient numbers and locations of watering places to protect the vegetative cover, or to make practicable the utilization of land for vegetative cover and protection of grassland from fires.

Certain land treatment measures, in addition to reducing floodwater, sediment, and erosion, will contribute to the expansion and perpetuation of wildlife resources. These treatment measures include the

planting of grass-legume mixtures and utilizing recommended species of trees and shrubs. Landowners and operators will be encouraged to make habitat plantings specifically for wildlife. They also will be encouraged to protect habitat along county roads, odd areas, fence lines, field borders, and drainageways. The Oklahoma Department of Wildlife Conservation will assist the Service and the districts by providing technical assistance in planning and promoting the establishment of fish and wildlife habitat development.

Present land use in the watershed seems to be moderately stable. The only significant change in land use anticipated in the foreseeable future will be the land the city will purchase for the installation of the structural measures included in the watershed work plan.

Structural Measures

Site 1 (drainage area 59.0 square miles) is a multipurpose structure incorporating floodwater detention, municipal and recreational storage, plus basic recreational facilities, and site 2 (drainage area 16.5 square miles) is a multipurpose structure incorporating floodwater detention and municipal storage. These sites comprise the works of improvement needed to provide protection to the flood plain lands that cannot be provided by land treatment alone. These structures will detain temporarily the runoff from 82 percent of the drainage area of the watershed from a 10-day storm that can be expected to occur on the average of once in 50 years. The floodwater retarding storage for sites 1 and 2 are 3.94 and 4.48 inches, respectively. Both sites are planned with 100-year sediment storage.

Preliminary investigations indicate that the open-top principal spillways will be located on non-yielding foundations. The risers will be set at the municipal pool elevation. Plunge basins are planned for both sites. The emergency spillways will be located in areas where the possibility of breaching is unlikely due to shale with sandstone layers underneath plus lengthy forebay areas with wide spillway widths. Adequate storage and release flows are planned to make possible the use of vegetated emergency spillways. Adequate borrow material of shale and gravelly shale is available including that in the spillway excavation and in the material of the sediment pool area for both sites.

Site 1 has 25,000 acre-feet of total storage, which includes 8,300, 1,226, 3,084, and 12,390 acre-feet of municipal, recreation, sediment, and floodwater detention storage, respectively. The surface area of permanent recreation, recreation, and municipal pools, respectively, are 350, 396, and 925 acres. The total area needed for site 1 is 2,758 acres, which includes 190 acres flowage easement and 2,568 acres to be purchased. A schedule of planned facilities is shown in Table 2B. Facilities to be installed for recreational use include

access roads, parking areas, sanitary facilities, fishing and passenger dock, launching ramps, and camping and picnicking areas. The recreational development will be available for public use. Land rights (which include purchase of land and relocation of road and power line) for this development will be cost-shared between local sponsors and P. L. 566 funds. The road relocation involves raising and revamping roadway structures in upper reaches of pool area. Cost and design data and a plan for the development are shown in Tables 2 and 3 and Figures 2, 3, 6, and 8.

Site 2 has 7,171 acre-feet of total storage, which includes 2,000, 1,229, and 3,942 acre-feet of municipal, sediment, and floodwater detention storage, respectively. The surface area of the municipal pool is 287 acres. Land rights, which include purchase of land, relocation of paved improved road, and utility relocations will be local cost. Local interest will also install sanitary facilities at the site. Cost data and design features are shown in Tables 2 and 3 and Figures 4, 5, and 8.

Vegetation measures will be used consisting of establishing selected plant species of high values for food, cover and nesting to mitigate losses of habitat in the construction of the impoundments. These plantings will be made within the fenced portion of the multipurpose structures and will be protected from fire and livestock.

Water supply lines (non-project measures) are planned to carry the municipal water to Frederick. Operation and maintenance of the municipal and recreational developments will conform to State and local health agency requirements.

EXPLANATION OF INSTALLATION COSTS

The installation cost of the entire project is estimated to be \$3,076,457, of which \$1,388,563 will be paid from Public Law 566 funds and \$1,687,894 will be borne by other funds. Total cost figures include funds for land treatment measures, \$412,000, and structural measures, \$2,664,457.

Land Treatment

Public Law 566 funds will include \$8,000 to provide technical assistance during the 5-year installation period which will accelerate the installation of land treatment measures included in the plan for watershed protection. These funds will be in addition to \$12,000 provided under existing programs. Landowners and operators will install these measures at an estimated cost of \$404,000 which includes ACP payments based on present program criteria (Table 1).

Multipurpose Structures

The use of facilities method was used to allocate joint costs of multi-purpose structures 1 and 2. Construction costs include the engineer's estimate plus 15 percent for contingencies. The engineer's estimate was based on the unit cost of structures in similar areas modified by special conditions inherent to these sites and determined by semi-detailed geological investigations consisting of core drilling the foundation and emergency spillway areas. Special features considered were embankment drainage, plunge basin, timber clearing, minor rock excavation, rock riprap, grouting, and outlet structures. The estimated cost of minimum basic recreational facilities was based on the cost of similar projects on other watersheds plus 15 percent for contingencies. Basis for allocation of cost is as follows:

<u>Purpose</u>	<u>Acre-Feet</u>	<u>Percent</u>
<u>Site No. 1</u>		
Flood Prevention 1/	15,474	61.90
Recreation	1,226	4.90
Municipal	8,300	33.20
Total	25,000	100.00

1/ Includes 3,084 acre-feet of sediment storage.

Site No. 2

Flood Prevention 2/	5,171	72.11
Municipal	2,000	27.89
Total	7,171	100.00

2/ Includes 1,229 acre-feet of sediment storage.

Land needed for the water resource improvement and recreational development is 2,758 acres, distributed as follows: 190 acres flowage easement for emergency spillway and flooded area outside purchase area, 1,730 acres within the reservoir taking line (100 feet horizontal from emergency spillway crest contour), 700 acres for recreational use outside the reservoir taking line, 70 acres for dam and spillway, plus 68 additional acres. There are 529 acres of municipal pool (surface area of municipal pool less surface area of recreation pool) included in the 1,730 acres of reservoir taking line. The P. L. 566 share for land purchase and relocation cost for site 1 is 38.38 percent, which is 50 percent times 2,500 acres (allowable acres to cost share) minus 529 acres (municipal) divided by 2,568 acres (total purchase area).

All land rights cost for multipurpose site 2 will be local cost. Cost estimates and the percent to be paid by P. L. 566 funds and by the City of Frederick are shown in the following table:

Measures	P. L. 566		Other Funds		Total
	: Percent	: Dollars	: Percent	: Dollars	
<u>Multipurpose Struct. No. 1</u>					
Construction	64.35	395,167	35.65	218,923	614,090
Engineering	66.80	36,223	33.20	18,003	54,226
Municipal Inlet					
Constr. & Engr.	0	0	100.00	69,420	69,420
Land Rights					
Purchase & Reloc.	38.38	202,877	61.62	325,723	528,600
Flowage Easement	0	0	100.00	9,500	9,500
Legal Fees	0	0	100.00	10,000	10,000
Rec. Facilities					
Constr. & Engr.	50.00	<u>126,421</u>	50.00	<u>126,421</u>	<u>252,842</u>
Subtotal		760,688		777,990	1,538,678
<u>Multipurpose Struct. No. 2</u>					
Construct. & Engr.	72.11	335,473	27.89	129,751	465,224
Municipal Inlet					
Constr. & Engr.	0	0	100.00	63,045	63,045
Land Rights					
Flowage	0	0	100.00	4,500	4,500
Purchase	0	0	100.00	164,000	164,000
Relocations	0	0	100.00	115,000	115,000
Legal Fees	0	0	100.00	10,000	10,000
Subtotal		335,473		486,296	821,769
TOTAL - Sites 1 & 2		1,096,161		1,264,286	2,360,447

Any necessary timber salvage will be land rights cost and will be the responsibility of the local sponsoring organization.

The cost of establishing wildlife habitat as mitigating measures is included in the estimated construction cost of the structures. The percentage of the cost to be paid by PL-566 funds and by local interest is the same as that included in the construction cost of the reservoirs.

Project Administration

Soil Conservation Service project administration costs for the structural measures include \$53,061 for administration and overhead and \$231,341 for construction inspection. Administration costs expected to be incurred by the local sponsors total \$19,608, which includes \$2,000 for construction inspection. The total cost for project administration is \$304,010.

Schedule of Obligation

The following table is an estimated schedule of funds for the 5-year project installation period and covers land treatment and structural measures:

: P. L. 566 Funds		Other Funds		:	
Fiscal Year	Land Treatment: Measures :(dollars)	Land Treatment: Measures :(dollars)	Structural :(dollars)	Structural :(dollars)	Total :(dollars)
1	1,600	202,877	1/	80,800	638,723
2	1,600	431,390	3/	80,800	306,346
3	1,600	126,421	4/	80,800	126,421
4	1,600	335,473	5/	80,800	192,796
5	1,600	0		80,800	0
Total	8,000	1,096,161		404,000	1,264,286
					2,772,447

1/ Land rights, Site 1.

2/ Land rights, Sites 1 and 2.

3/ Construction of Site 1.

4/ Construction basic recreational facilities.

5/ Construction of Site 2.

EFFECTS OF WORKS OF IMPROVEMENT

Agricultural benefits accruing to this project are based on reduction of damages on 573 acres of flood plain land below two proposed multi-purpose structures. The flood plain area will receive protection from land treatment measures applied on the watershed lands and from flood-water storage included in the multipurpose structures.

The system of two structures will control runoff on 82 percent of the watershed and reduce flooding, caused by a 100-year frequency runoff event, from 573 acres to 151 acres. Flooding from the 25-year runoff event will be reduced from 490 acres to approximately 8 acres. Flooding will be eliminated for all runoff events smaller than the 25-year frequency. The average annual flooding for future conditions with the project installed would be only 4 acres.

The estimated peak discharges computed for future conditions without the project would be reduced about 73 percent with the project installed and functioning.

Virtually all floodwater and associated damages will be eliminated. Crop and pasture, other agricultural damages, and nonagricultural damages will be reduced by about 98 percent. Sediment and scour damages will be reduced by approximately 88 and 98 percent, respectively.

The project will reduce peak flows and make it possible to replace obsolete bridges, and bridges washed out and not as yet replaced, with modern structures of less capacity at considerably lower cost. Although this would be a significant figure, it was not evaluated for project justification.

Approximately 25 farm operators will benefit directly from flood damage reductions on 573 acres of flood plain within the watershed. An additional 100 farm operators will benefit in varying degrees downstream from the watershed. Although these benefits were significant, they were not evaluated for project justification. Many more farmers and residents in the area will benefit indirectly from reduced flooding conditions.

Population for Frederick is projected to increase from 7,000 in 1970 to 12,000 in 2010. This population growth will be made possible by the dependable supply of water of excellent quality provided by the structures. Such users as feedlots, golf course, Dallas Aeromotive, and granite works will be provided a stable supply of water. Additional industries will be attracted to the area.

The storing of surface water for municipal and industrial use will relieve the demands for water, from the terrace deposits, that is presently used by Frederick, thus releasing this ground water for use by irrigation farmers in the area.

A population of 158,000 in a 50-mile radius of the multipurpose structures will have an opportunity to participate in water-oriented sports provided by the two multipurpose structures.

Nonagricultural Water Management

It is estimated that 74,000 people will visit site No. 1 with its accompanying recreational facilities annually. A value of \$1.50 per visitor day was used to evaluate the monetary worth of the facilities. Visitors will be able to engage in such activities as picnicking, fishing, hiking, boating and sightseeing. The facilities will be available the entire year, but the most concentrated use will be during the spring and summer seasons. The peak daily use is expected to be about 2,000 people.

Multiple purpose site No. 2 will be open to the public for recreational use and sanitary facilities will be provided by the city of Frederick. It was estimated that 13,000 people would visit site No. 2 annually. A value of fifty cents per visitor day was used to determine the monetary value of the incidental recreation.

Effects of Project Measures on the Wildlife Resource

Land treatment measures, installed on privately owned land, proposed by this project will retard runoff and stabilize eroding land, thus preserving the total area for use by future generations while maintaining and improving current land use conditions. Proper range management on 72 percent of the watershed and the conservation measures planned for the 25 percent in cultivation will improve the habitat and feeding conditions for wildlife.

The local sponsors will purchase and fence 3,077 acres surrounding the two multiple purpose pools. The resource use on these acres will change from its present use of range land and crop production. The normal pools will inundate 1,212 acres. Flood pools will occupy 985 acres. Another 810 acres will be used for a recreational development and the dams and emergency spillways will occupy 70 acres.

The inundation of 1,212 acres by the normal pools will constitute a loss of habitat to the existing wildlife but will provide needed resting and feeding habitat for waterfowl and shore birds. Approximately 8 miles of stream channel will be inundated by these pools that will provide good fishing. The flow in these streams is intermittent and without the project would provide no fishing resource.

Vegetative cover will return to its maximum natural state on the 985 acres of flood pool areas that will not be grazed or cultivated.

Wildlife plantings of native shrubs and plants will be made in this protected area to provide wildlife habitat.

A 40 acre prairie dog town located in the area to be purchased for recreation, will be preserved for the public and protected by a post and cable enclosure to be installed before project construction begins.

The vegetative cover that will be maintained and protected from grazing on the dam and spillway area (70 acres) will provide wildlife habitat.

The project will provide protection through reduced flooding to wildlife such as quail, dove and rabbits, using the habitat bordering downstream channels.

PROJECT BENEFITS

The average annual floodwater, sediment, erosion, and indirect damages with future conditions but without project on the Deep Red Run-Coffin Creek Watershed is estimated to be \$45,937 (Table 5). With the proposed land treatment and structural measures installed, it is estimated that these damages will be reduced to \$605 annually, or 99 percent reduction. Estimated damage reduction benefits accruing to structural measures are \$43,065 (Table 6). In addition, it is estimated that the proposed land treatment measures will provide annual flood reduction benefits of \$2,267.

Annual project benefits to crops and pastures are estimated to be \$2,265. Damages to other agricultural properties are reduced by \$2,700, and damages to nonagricultural properties, such as roads and bridges, are reduced by \$29,657 annually. Damages from overbank sediment deposition are reduced by \$1,901 annually, and sediment damage to Texoma is reduced by \$600. Damages caused by erosion of flood plain land are reduced by \$4,088, and indirect damages are reduced by \$4,121.

The total average annual benefits attributed to P. L. 566 waterflow control structural measures on Deep Red Run-Coffin Creek Watershed are shown in Table 6 and listed as follows: floodwater damage reduction, \$43,065; incidental recreation, \$9,343; nonagricultural water management (recreation), \$110,352; nonagricultural water management (municipal water), \$294,364; secondary, \$89,317; total benefits, \$546,441.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures (converted from total installation costs, plus operation and maintenance and project administration costs) is \$178,259 (Table 4). When the project is completely installed, the structural measures are expected to produce average annual primary benefits of \$457,124. The ratio of benefits to costs without secondary benefits is 2.6:1.

Total average annual benefits amounting to \$546,441, including secondary benefits, will provide benefits of \$3.10 for each dollar of equivalent costs (Table 6).

PROJECT INSTALLATION

The sponsoring organizations, with the assistance of the Extension Service, Vocational Agriculture, and other interested agencies, will carry out the educational phase of the program. This will be accomplished by conducting general information and local farm meetings, preparing radio and press releases, and using other methods of getting information to landowners and operators and other interested groups in the watershed. This will help achieve understanding and stimulate participation in the entire plan, including the land treatment practices and the structural measures for flood prevention.

Land Treatment Measures

The land treatment measures will be established by farmers and ranchers over a 5-year period in cooperation with the Tillman, Kiowa, and Comanche County Soil and Water Conservation Districts. The land treatment measures will be carried out with the assistance from the Soil Conservation Service work unit in each district. The assistance will be accelerated to assure application of the planned measures within the installation period of the project. Land treatment measures and funds for accelerated technical assistance are shown in Table 1. The Soil Conservation Service will, as needed, assign additional personnel to assist landowners and operators in accelerating planning and application of soil and water conservation practices.

The governing bodies of the soil and water conservation districts will assume aggressive leadership in accelerating the planned land treatment measures. The landowners and operators within the watershed will be encouraged to apply and maintain soil and water conservation measures on their farms and ranches. District-owned equipment will be made available to the landowners and operators in accordance with existing arrangements for equipment usage in the district.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies to outline the services available and eligibility requirements.

The Oklahoma Department of Wildlife Conservation will assist the Service and the districts by providing technical assistance in planning and promoting the establishment of fish and wildlife habitat developments.

Structural Measures

The contract for the construction of the multipurpose structures, including the water resource improvement and the minimum basic recreational facilities, will be made by the City of Frederick.

The Service will provide construction inspection for all features of the installation of the multipurpose structures where cost sharing of funds are involved. Local interest will provide construction inspection for all items of construction installed with 100 percent sponsor's funds. The Service or the sponsors may, at their own option, inspect the installation of any portion of the works of improvement.

Land rights costs on 2,568 acres of land needed for the recreational development and the cost of relocation or modification of roads and improvement involved in site 1 will be cost-shared with the P. L. 566 share, being 38.38 percent of the cost actually expended for this purpose, the balance of costs to be furnished by local interest. Legal fees and flowage easements for site 1 will be local sponsor cost. All land rights cost (which includes relocation of paved road) and legal fees for site 2 will be local sponsor (City of Frederick) cost.

Federal funds may be provided and construction of multipurpose structures and developments may be started when the following conditions are met:

1. Land Rights

- a. Either all necessary land rights or options for land rights have been obtained for both multipurpose structures.
- b. Sponsoring local organizations have adequate financial resources and legal authority to acquire land rights by eminent domain and have satisfied the State Conservationist that they will use these powers and resources to secure all needed land rights.

2. Operation and Maintenance

- a. A fund for maintenance is established to pay for uncontributors labor, equipment, and supplies.
- b. The approved operation and maintenance agreement has been approved.

3. Goals are set to meet the following land treatment requirements for the construction of each structure in the plan:

- a. Farm and ranch conservation agreements to carry out recommended soil conservation practices on more than 50 percent of the farmlands in the drainage area above the floodwater retarding structure.
- b. More than 75 percent of the effective land treatment above the floodwater retarding structure have been installed or are scheduled to be installed prior to completion of the floodwater retarding structure on those sediment source areas which, if uncontrolled, would require a material increase in the cost of construction and maintenance of the dam.

4. The project is approved and Public Law 566 funds are available.

Designs and specifications for the two reservoirs will be developed by private consulting engineers employed by the City of Frederick. Technical assistance will be provided by the Soil Conservation Service in review and approval of designs, construction inspection, final inspections, executions of certificates of completion, and related tasks for the establishment of the planned multipurpose structures and developments.

A schedule to establish the structural measures within a 5-year period will be developed and adjusted from year to year on the basis of any significant changes in the plan to be mutually desired by the cooperating parties and in line with actual appropriations and accomplishments.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the structural works of improvement and technical assistance for accelerated land treatment as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended.

Federal assistance is contingent upon local organizations meeting their necessary prior obligations and on the appropriation and allotments of Federal funds for these purposes.

The sponsoring organizations recognize their obligations and expected expense and are prepared to carry out their part of project installation.

The cost of land treatment measures will be borne by the individual farmers and ranchers on whose land these measures are installed. The County Agricultural Stabilization and Conservation Committee and the Great Plains Program Committee will cooperate with the governing bodies of the soil and water conservation districts by selecting and providing financial assistance for those land treatment measures which will accomplish the conservation objectives in the shortest possible time. The soil and water conservation loan program of Farmers Home Administration is available to all eligible individual farmers and ranchers in the area. Present FHA clients will be encouraged to cooperate.

The non-Federal cost of installing multipurpose structural measures, including the water resource improvement, minimum basic recreational facilities, and land rights, will be financed by the City of Frederick through revenue bonds, grants, and donations. When donations of material, equipment, and services are used to finance a portion of the local share, an estimate of the value for these donations will be made to determine equal share in the cost-sharing of facilities.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

The land treatment measures on privately-owned lands will be operated and maintained by the landowners or operators of the farms on which the measures are installed, under agreements with the Tillman, Kiowa, and Comanche County Soil and Water Conservation Districts. Representatives of the district will make periodic inspections of the land treatment measures on the land to determine maintenance needs and will encourage landowners and operators to perform needed maintenance. District-owned equipment will be made available for this purpose.

Structural Measures

The City of Frederick will operate and maintain multipurpose structures 1 and 2 and the recreational development in connection with site 1 and furnish the funds needed for this purpose.

The normal operating range for the municipal pool of site No. 1 will be 1200.3 feet to 1186.0 feet, with surface areas of 925 and 350 acres, respectively. The total capacity within the operating range is 9,073 acre feet. When the reservoir is operated below the specified ranges, the City of Frederick will notify the Service, through the State Conservationist. If it is determined there is a continuing need for the use of the recreation storage for municipal purpose, the City of Frederick will reimburse the Federal Government for all P. L. 566 funds used for the public recreation cost associated with the reservoir.

The estimated average annual value of operation and maintenance is based on adjusted normalized prices and maintenance needs on similar watersheds. Necessary maintenance will be accomplished through the use of contributed labor and equipment, by contract, or by a combination of these methods. The average annual maintenance for multipurpose structures 1 and 2 is \$800 and for the recreational development is \$40,000 (which includes replacement cost of \$3,641). A maintenance fund will be established prior to awarding contracts for construction.

Prior to Federal funds being made available for construction through a project agreement, the local sponsoring organizations will prepare and execute an agreement satisfactory to the State Conservationist for operation and maintenance of structural measures and recreational facilities to be installed. The maintenance agreement will declare the amount of funds on hand for maintenance purposes; also methods of replacing the funds as portions are used. Provisions will be made for free access of District, State, and Federal representatives to inspect all structural measures and their appurtenances at any time.

Operation and maintenance inspections for the multipurpose structures will be made on the following basis:

1. The Service employee responsible for operation and maintenance inspection and followup and the sponsors will make a joint inspection annually, after unusually severe floods and after the occurrence of any other unusual conditions that might adversely affect the structural measures. These inspections will continue for three years following installation of each structure. Inspections after the third year will be made annually by the sponsors. They will prepare a report and send a copy to the Service employee responsible for operation and maintenance inspection and followup.
2. The Service employee responsible for operation and maintenance inspections and followup will thoroughly review the sponsors' operation and maintenance reports of inspections and maintenance. Evidence that inspections or needed maintenance are not being performed properly and promptly will be reported immediately to the State Conservationist who must then take appropriate action on the reported deficiencies.

An "establishment period" of three years after the acceptance of a structural work of improvement is hereby prescribed. During this period the Service may bear such part of the cost of any needed repairs as is proportionate to the original costs borne by the Service in the construction of the works of improvement. Specifically excluded from the policy are:

1. Routine upkeep including replacement of minor or short-lived parts of structures, equipment, or facilities.
2. Repairs determined by the Service to have been caused by improper operation or routine upkeep or both.
3. Repairs for any purpose for which construction costs are not authorized to be paid for in whole or in part with funds appropriated to the Service.

The sponsors understand and recognize their responsibilities in the operation and maintenance of the project measures.

It is understood that the functions of operation and maintenance include the items discussed in the following paragraphs and, in addition, any other unforeseen maintenance needs.

"Operation" is action taken by the sponsors to make the structure function as designed. It includes the operation of gates and other features to regulate the retention or release of water for flood control or other use in accordance with a predetermined plan. Operation must comply with state or local laws as they apply to the use and control of water.

Operation of the recreational development includes removal of trash and debris from picnic areas, keeping water and sanitary facilities in compliance with Public Health laws, and providing an orderly recreational development.

"Maintenance" is work done by the sponsors to keep the structure and recreational facilities in good operating condition during its useful life.

The maintenance of an adequate vegetative cover of desirable species requires the repairing and reseeding of eroded areas, cutting or spraying to remove or control undesirable vegetation and fertilization.

Earth dam maintenance should include replacement of soil removed by rodents, cleaning out or replacement of relief wells or drains, repair of damaged riprap, stabilization of slide areas, keeping dikes at proper elevation and replacing eroded material, and immediate revegetation of any eroded areas that develop in the emergency spillway.

The maintenance of basic recreational facilities includes replacement or repair of damaged picnic facilities, boat docks, launching ramps, all sanitation facilities, fencing, water facilities, electrical facilities, roads and parking areas, and repair and reseeding of eroded vegetated areas.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST 1/

Deep Red Run-Coffin Creek Watershed, Oklahoma

Installation Cost Item	Unit	Number To Be Applied	Estimated Cost 2/	
			Public Law: 566 Funds	Other 3/: Total (dollars)

LAND TREATMENT 1/

Soil Conservation Service				
Cropland	Acre	3,600	140,000	140,000
Grassland	Acre	12,800	192,000	192,000
Miscellaneous Land	Acre	640	60,000	60,000
Technical Assistance			8,000	12,000
				20,000
TOTAL LAND TREATMENT			8,000	404,000
				412,000

STRUCTURAL MEASURES

<u>Construction</u>				
Multipurpose Struct.	No.	2	701,398	462,364
Basic Rec. Facilities	No.	1	114,928	114,928
<u>Subtotal - Constr.</u>			<u>816,326</u>	<u>577,292</u>
				<u>1,393,618</u>
Engineering Services			76,958	48,271
				125,229
<u>Project Administration</u>				
Construction Inspection			231,341	2,000
Other 4/			53,061	17,608
<u>Subtotal - Administration</u>			<u>284,402</u>	<u>19,608</u>
				<u>304,010</u>
<u>Other Costs</u>				
Land Rights			202,877	638,723
				841,600
TOTAL STRUCTURAL MEASURES			1,380,563	1,283,894
				2,664,457
TOTAL PROJECT			1,388,563	1,687,894
				3,076,457

1/ No Federal land included

2/ Price Base 1969.

3/ Includes reimbursement from ACPS and other Federal funds under going programs.

4/ Public Law 566 costs include Washington and State offices. Other costs include local sponsors' costs.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Deep Red Run-Coffin Creek Watershed

Measures	: Unit	: Applied To Date	: Total Cost (Dollars) 1/
<u>LAND TREATMENT</u>			
Soil Conservation Service			
Conservation Cropping System	Acre	9,500	115,900
Contour Farming	Acre	1,700	510
Cover and Green Manure Crop	Acre	1,050	8,663
Crop Residue Use	Acre	9,500	11,875
Grassed Waterways	Acre	420	55,440
Terrace, Gradient	Foot	464,640	18,585
Diversion	Foot	35,500	3,550
Brush Control	Acre	5,170	79,101
Farm Ponds	No.	192	136,512
Pasture & Hayland Planting	Acre	3,000	18,900
Pasture & Hayland Renovation	Acre	1,500	24,450
Range Deferred Grazing	Acre	2,000	400
Proper Grazing Use	Acre	23,000	11,500
Wildlife Habitat Development	Acre	20	2,000
TOTAL			487,386

1/ Price Base 1969.

September 1970

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Deep Red Run-Coffin Creek Watershed, Oklahoma

(Dollars) 1/

Item	Installation Cost - P. L. 566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Total	: Construction:Engineering	: Land Rights:	P. L. 566	: Construction:Engineering	: Land Rights:	
Multiple Purpose Structure No. 1	395,167 2/	36,223	202,877 3/	634,267	218,923 2/	18,003	345,223 4/ 1,216,416
Municipal Outlet	0	0	0	0	65,000	4,420	0 69,420 69,420
Recreational Facilities	114,928	11,493	0	126,421	114,928	11,493	0 126,421 252,842
Subtotal	510,095	47,716	202,877	760,688	393,851	33,916	345,223 777,990 1,538,678
Structure No. 2	306,231 2/	29,242	0	335,473	118,441 2/	11,310	293,500 5/ 423,251 758,724
Municipal Outlet	0	0	0	0	60,000	3,045	0 63,045 63,045
Subtotal	306,231	29,242	0	335,473	178,441	14,355	293,500 486,296 821,769
TOTAL	816,326	76,958	202,877	1,096,161	577,292	48,271	638,723 1,264,286 2,360,447
Project Administration				284,402			19,608 304,010
GRAND TOTAL	816,326	76,958	202,877	1,380,563	577,292	48,271	638,723 1,283,894 2,664,457

1/ Price Base 1969.

2/ Includes cost of wildlife plantings for mitigation.

3/ Includes \$2,757 relocation of road and power line.

4/ Includes \$9,243 relocation of road and power line and \$10,000 for legal fees and surveys.

5/ Includes \$115,000 relocation of road and \$10,000 for legal fees and surveys.

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TABLE 2A - COST ALLOCATION AND COST-SHARING SUMMARY

Deep Red Run-Coffin Creek Watershed, Oklahoma

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING		
	PURPOSE			OTHER		
	Flood	Municipal:	P. L. 566	Municipal:	P. L. 566	Other
	:Prevention:Recreation:	Water :	Total :	:Prevention:Recreation:	Water :	Total :
Multiple Purpose						
Structure No. 1 2/	423,369	446,038	416,429	1,285,836	413,688	220,579
Structure No. 2 3/	342,973	-	478,796	821,769	335,473	-
36 Recreation Facilities					335,473	7,500
Structure No. 1	-	252,842	-	252,842	-	126,421
						126,421
GRAND TOTAL	766,342	698,880	895,225	2,360,447	749,161	347,000
					-	1,096,161
						17,181
						351,880
						895,225
						1,264,286

1/ Price Base 1969.

2/ Municipal and Recreation.

3/ Municipal.

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TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS
 Site 1 (R & M)

Deep Red Run-Coffin Creek Watershed
 (Dollars)

Item		: Estimated	Total
	: Number	: Unit	: Construction
	:	: Cost	: Cost
1. Roads			
a. Roadbed (improved)	2.9 Mi.	24,000	69,600
b. Roadbed (unimproved)	3.4 Mi.	9,300	31,620
c. Trails	8.7 Mi.	800	6,960
2. Parking Areas			
a. Gravel Base & Surface	5,000 Sq.Yd.	3	15,000
3. Utilities			
a. Water Systems & Dist. Line	3 Job	1,500	4,500
b. Electricity & Lighting	1 Job	2,500	2,500
4. Sanitary Facilities			
a. Flush Toilet, 4-unit, Div. (2 seats each sex)	3 Each	6,100	18,300
b. Septic Tank & Disp. Field	3 Each	1,300	3,900
c. Trash & Garbage Disposal (anchored on concrete slab)	25 Each	25	625
d. Pit Toilet (double seat)	2 Each	600	1,200
5. Picnic Facilities			
a. Tables (3 x 6')	40 Each	70	2,800
b. Group Shelters (20 x 40') (concrete floor)	1 Each	3,000	3,000
c. Cook Grills	25 Each	60	1,500
6. Boating			
a. Launching Ramps (concrete)	3 Each	790	2,370
7. Fishing & Passenger Dock			
	1 Each	1,200	1,200
8. Landscaping & Vegetation			
	15 Acre	150	2,250
9. Fencing			
	12.7 Mi.	2,500	31,750
10. Signs			
	4 Each	200	800
Subtotal			199,875
Contingencies			29,981
GRAND TOTAL			229,856

1/ Price Base 1969
 4-29752 9-70

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TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Deep Red Run-Coffin Creek Watershed

Item	Unit	Structure Number		Total
		1	2	
Class of Structure		b	b	xxx
Drainage Area	Sq. Mi.	59.00	16.50	75.50
Curve No. (1-day) (AMC II)		78	79	xxx
Tc	Hour	4/	3.29	xxx
Elevation Top of Dam 1/	Foot	1,216.0	1,212.2	xxx
Elevation Crest Emergency Spillway 1/	Foot	1,211.0	1,207.0	xxx
Elevation Municipal Pool 1/	Foot	1,200.3	1,197.0	xxx
Elevation Recreation Pool 1/	Foot	1,187.5	-	xxx
Elevation Sediment Pool 1/	Foot	1,182.5	1,185.2	xxx
Maximum Height of Dam 1/	Foot	63	48	xxx
Volume of Fill	1,000 Cu.Yd.	600	402	1,002
Total Capacity 1/	Ac. Ft.	25,000	7,171	32,171
Sediment Submerged 100 Years 1/	Ac. Ft.	1,857	730	2,587
Sediment Submerged Recreation	Ac. Ft.	378	-	378
Sediment Submerged Municipal	Ac. Ft.	220	244	464
Sediment Aerated 1/	Ac. Ft.	629	255	884
Beneficial Use Municipal	Ac. Ft.	8,300	2,000	10,300
Beneficial Use Recreation	Ac. Ft.	1,226	-	1,226
Retarding 1/	Ac. Ft.	12,390	3,942	16,332
Surface Area				
Sediment Pool	Acre	253	112	365
Recreation Pool	Acre	396	-	396
Municipal Pool	Acre	925	287	1,212
Retarding Pool	Acre	1,620	577	2,197
Principal Spillway				
Rainfall Volume (areal) (1-day)	Inch	6.99	7.32	xxx
Rainfall Volume (areal) (10-day)	Inch	11.66	11.88	xxx
Runoff Volume (10-day)	Inch	4.87	5.86	xxx
Capacity (Max.)	Cfs.	670	198	xxx
Frequency Operation - Emer. Spwy. 2/	% Chance	2	2	xxx
Size of Conduit	Diam. (In.)	60	36	xxx
Emergency Spillway				
Rainfall Volume (ESH) (areal)	Inch	8.32	8.73	xxx
Runoff Volume (ESH)	Inch	5.58	6.19	xxx
Type	Veg.		Veg.	xxx
Bottom Width 1/	Foot	800	300	xxx
Velocity of Flow (V_e) 3/	Ft./Sec.	6.6	6.3	xxx
Slope of Exit Channel	Ft./Ft.	0.022	0.023	xxx
Maximum Water Surface Elev. 1/ 3/	Foot	1,212.9	1,209.0	xxx
Freeboard				
Rainfall Volume (FH) (areal)	Inch	14.07	15.00	xxx
Runoff Volume (FH)	Inch	11.18	12.22	xxx
Maximum Water Surface Elev. 1/ 3/	Foot	1,216.0	1,212.2	xxx
Capacity Equivalents 1/				
Sediment Volume	Inch	0.98	1.40	xxx
Retarding Volume 2/	Inch	3.94	4.48	xxx

1/ Subject to minor adjustment in final design.

2/ Equals or exceeds minimum requirements in Washington Engineering Memo 27.

3/ Maximum during passage of hydrograph.

4/ Developed by incremental areas.

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TABLE 4 - ANNUAL COST

Deep Red Run-Coffin Creek Watershed, Oklahoma

(Dollars)

Evaluation Unit	: Amortization of : Operation and :	: Installation :	Maintenance :	Total
	: Cost <u>1/</u>	: Cost <u>2/</u>		:
Multipurpose Structures 1 and 2 and Basic Recreational Facilities	121,775	40,800		162,575
Project Administration	15,684	-		15,684
TOTAL	137,459	40,800		178,259

1/ Price Base 1969, amortized for 100 years at 5 1/8 percent.

2/ Adjusted normalized prices.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Deep Red Run-Coffin Creek Watershed, Oklahoma

(Dollars) 1/

Item	<u>:Estimated Average Annual Damage:</u>			Damage Reduction Benefit
	: Without Project	: With Project	: Project	
Floodwater				
Crop and Pasture	2,300		35	2,265
Other Agricultural	2,717		17	2,700
Nonagricultural				
Roads and Bridges	<u>29,703</u>		46	<u>29,657</u>
Subtotal	34,720		98	34,622
Sediment				
Overbank Deposition	2,163		262	1,901
Texoma Reservoir	<u>707</u>		107	600
Subtotal	2,870		369	2,501
Erosion				
Flood Plain Scour	<u>4,171</u>		83	4,088
Subtotal	4,171		83	4,088
Indirect	4,176		55	4,121
TOTAL	45,937		605	45,332

1/ Price Base: Adjusted normalized prices.

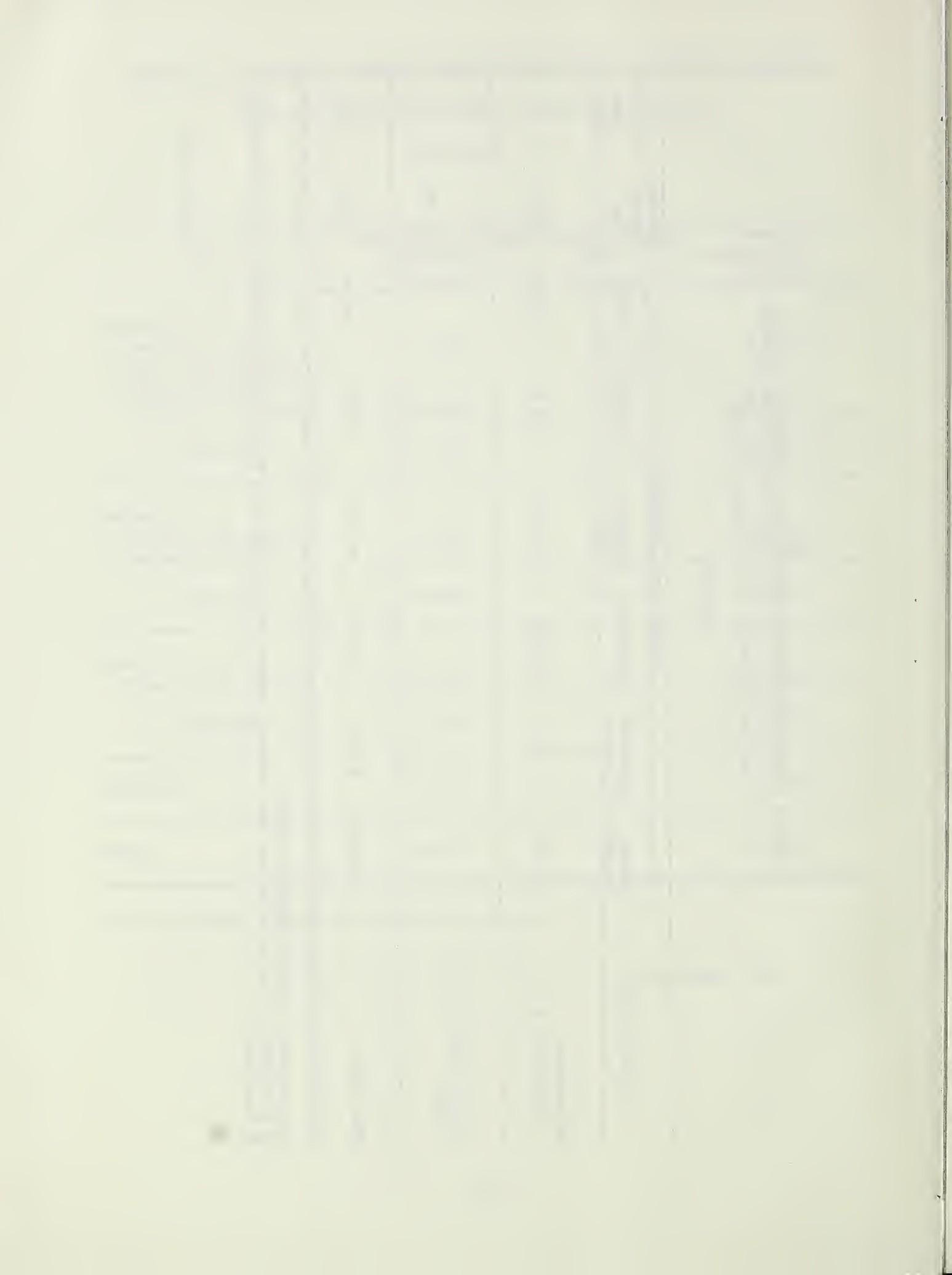
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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
 Deep Red Run-Coffin Creek Watershed, Oklahoma
 (Dollars)

Evaluation Unit	Average Annual Benefits 1/			Average			
	Damage	Incidental	Recreation	Municipal	Secondary	Total	
						Annual	
						Cost	
						3/	
						Ratio	
Multipurpose Structures 1 & 2	43,065	9,343	110,352	294,364	89,317	546,441	162,575
Project Administration Costs	-	-	-	-	-	-	15,684
GRAND TOTAL	43,065	2/ 9,343	110,352	294,364	89,317	546,441	178,259

1/ Price Base: Adjusted normalized prices.
 2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$ 2,267 annually.
 3/ From Table 4.

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INVESTIGATIONS AND ANALYSES

Land Use and Treatment

Land Treatment Measures

The land use on the upland was determined from existing work unit records and from detailed sediment source studies above the multipurpose structures. The land use of the flood plain was planimetered from the flood plain strip map developed during the hydrologic and economic investigations.

Current conservation needs and amounts of conservation practices applied to date were based on estimates developed by the local Soil Conservation Service personnel assisting the soil and water conservation districts. Based on the needs and local experience, an estimate was made of the measures that could be applied in the 5-year installation period. The acres by land use needing treatment and total cost of those measures which will be applied during the project installation period are shown in Table 1. Although needed land treatment measures will accomplish some flood damage reduction, it was apparent that structural measures would be required to attain the degree of flood protection desired.

Soil Cover Conditions

The hydrologic cover conditions in the watershed were determined from:

1. Conservation needs inventory.
2. A sampling of soil survey information.
3. Data furnished by the district conservationist and soil scientist.
4. Detailed sediment source studies.
5. Data gathered in the economic investigation of the flood plain area.

Wildlife Investigations

Personnel from the following agencies participated in the biological reconnaissance trip within the watershed: Oklahoma Department of Wildlife Conservation, Bureau of Sport Fisheries and Wildlife, and the Soil Conservation Service.

A biological reconnaissance report was written for the watershed discussing the general nature and importance of the wildlife resources, effects of project measures on wildlife resources, and the possibilities of lessening damages and enhancing wildlife habitat.

A reconnaissance report also was prepared by the USDI Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife.

Engineering Investigations

After considering the effect of land treatment measures, determinations were made for the structural measures needed to attain project objectives (including flood prevention and recreation and municipal uses). The study made and the procedures used in that determination, in conjunction with the Service, sponsors, and consulting engineers, are as follows:

1. The location of the structural measures shown in this plan was determined through the use of engineering field survey data, aerial photographs, contour maps, and soils maps. The field surveys included the items listed below.
 - a. The development of topographic maps complete with storage data and curves for two multipurpose structures.
 - b. Survey and plotting of seven valley sections to be used in the hydrologic investigations.
 - c. Preliminary geologic investigation to determine foundation conditions, type of material in the spillway, and availability of borrow material.
2. The engineering criteria of Washington Engineering Memorandum No. 27 (revised March 1965) were used to design the multi-purpose structures using floodwater storage for class "b" criteria.

The top of the principal spillway riser is placed at the top of municipal pool elevation with 100-year sediment below this elevation for both sites, plus recreational storage also in site 1.

The emergency and freeboard hydrographs for site 1 were developed for two separate areas, then routed to determine spillway width and freeboard, and the hydrographs for site 2 were developed for the total area involved.

3. Contract cost estimates were made in concurrence with city-employed engineers and were based on:
 - a. Computed embankment yardage.
 - b. Estimated acres of timber clearing.
 - c. Principal spillway size and length.
 - d. Estimated foundation drainage.
 - e. Estimated rock excavation.
 - f. Slope protection - riprap.
 - g. Plunge basin size.
 - h. Quantity of grouting.
 - i. Vegetation.
 - j. Salvaging and placing topsoil.

Cost data are shown in Table 2.

4. Private professional engineers employed by the City of Frederick have made a study of water quality from samples taken of runoff from the watershed. Analysis made by water quality consultants indicated that the water is of excellent mineral quality and is considerably better than the ground water supplies currently being used by the city, and will meet the standards of the Oklahoma Department of Health in every detail. As part of the investigation, reservoir operation studies were made on both sites to determine the safe yield. The safe yield for site 1 was determined to be 2.0 mgd and for site 2 to be 0.5 mgd, giving a total yield for municipal purposes from the two sites of 2.5 mgd.
5. Costs of structural measures and of land rights and of relocation of roads, bridges, and powerlines were all considered in arriving at the least costly system of measures to accomplish the project objectives.
6. Operation and maintenance costs of the structures were based on those costs for similar structures installed on other watersheds using adjusted normalized prices. These costs for site 1 include the replacement cost of the recreational facilities included in the plan that have a shorter life than the evaluation period of the project. The annual cost of these items was determined by converting the future replacement cost to a present worth value and amortizing over the project evaluation period.

Hydraulic and Hydrologic Investigations

The following steps were taken as a part of the hydraulic and hydrologic investigation and determinations:

1. Precipitation data collected by the U. S. Weather Bureau at Frederick, Oklahoma and U. S. Weather Bureau Technical Paper 40 were used to establish the rainfall-frequency relationship.
2. Hydrologic conditions of the watershed were determined by considering such factors as climate, geology, topography, soils, land use, and vegetative cover. Soil cover complex data were assembled using these factors.
3. Engineering surveys were made of channel and valley cross sections selected to represent adequately the stream hydraulics and the flood plain area. Preliminary locations for cross sections were made by stereoscopic examination of aerial photographs of the flood plain. The final locations were selected in the field.
4. Cross-section rating curves were computed from field survey data as described in item 3 above, by solving water-surface profiles for various discharges.
5. Unit hydrographs were developed and routed using the coefficient method of flood routing to establish the runoff-peak discharge relationship. One system of structures was routed and analyzed. The frequency-peak discharge relationship was checked and adjusted to regional analysis data.
6. Area-inundated data were developed under conditions that would exist due to:
 - a. Future conditions without project.
 - b. Future conditions with project installed.
7. The appropriate spillway design storms for areas involved were selected from criteria contained in the National Engineering Handbook, Section 4, Hydrology, and Engineering Memorandum-27.

Hydrographs for two separate areas were developed for site 1, then routed using convex routing method to develop combined

hydrographs for the spillway and freeboard design storms. These hydrographs were routed graphically, using various spillway widths and depths to determine freeboard and emergency spillway width. The runoff (Table 3) for the entire drainage area was determined by planimetering area under the combined hydrographs. Site 2 hydrographs were developed for the entire drainage area, then routed graphically, using various spillway widths and depths to determine the freeboard and emergency spillway width.

Reservoir Operation

The reservoir operation studies were made on the multipurpose reservoirs in conjunction with the consultants for the City of Frederick, using the following data:

1. Storage data tables for sites 1 and 2 were developed and plotted as shown in Figures 2 and 4, respectively.
2. The most critical drought period of record (water years 1963 through 1968) was selected for the study.
3. The U. S. Geological Survey gage records on Deep Red Run Creek in Cotton County were used to obtain monthly inflow in acre-feet per square mile.
4. The following records were used to compute the net evaporation from the reservoir surface:

U. S. Weather Bureau Standard Rain Gage at Frederick, Okla.

U. S. Weather Bureau Technical Paper 37.

U. S. Weather Bureau Class A Pan Records at Altus Dam and Tipton, Okla.

5. Monthly future water requirements for Frederick were determined by the consulting engineers (average monthly demand of 233 acre-feet).
6. Seepage was considered nil.

Site 1

The reservoir was operated through the selected study period, assuming evaporation demand only, to determine the loss from evaporation. This loss was proportioned to recreation and municipal storage on acre-feet to determine the minimum storage and surface area of the permanent recreation pool.

The reservoir was operated through the selected study period, assuming evaporation and municipal demand, to determine minimum storage and surface area and to assure that the combined demand would not encroach on the permanent recreation pool. The average monthly demand used for municipal water supply was 186 acre-feet.

The result of the combined demand is shown in Figure 3, which indicates that the combined demand does not encroach on the permanent recreation pool.

Site 2

The reservoir was operated through the selected study period, assuming evaporation and municipal demand, to determine minimum storage and surface area and to assure an adequate municipal water supply. The average monthly demand used for municipal water supply was 47 acre-feet. Adequate storage was provided as shown in Figure 5.

Sedimentation Investigations

A field survey of sedimentation problems in the watershed was made in accordance with national technical releases and guides.

Flood Plain Sedimentation and Scour Damage

Field studies included reconnaissance surveys of geology and physiography, studies of overbank sediment deposits, flood plain scour, streambank erosion, and the nature of the channels and valleys on or near all valley cross sections. Borings were made by the geologist along all the valley cross sections to determine the nature and thickness of sediment deposits. Damage categories were based on depth and texture in case of deposits and on the amount of soil removal where scour occurred. Loss of productivity was determined by interviews with farmers and corroborated by the staff economist. In preparation of the reports, tabular summaries of all the above finds, with explanatory text, were prepared.

Sediment Source Studies

Sediment source studies were made in detail on the drainage areas above all the proposed floodwater retarding structure sites which represent over 80 percent of the total area in the watershed. Sediment yields were calculated separately for each soil unit, land use, and cover condition in the drainage area. Other parameters used in the studies were percent and length of slope, basic erosion rate of the soil, cover and rainfall factors, and realistic estimates of land treatment measures that will be applied during the installation period. Present erosion rates were adjusted to reflect this future land treatment. Factors affecting future sediment yields, such as the occasional destruction of cover by fire, deterioration due to droughts, and possible land-use changes, were considered in calculating sediment storage for the structures. Sediment derived from gully and streambank erosion was estimated by field studies, comparison of old and recent aerial photographs, and

by interviews with landowners in the watershed who were able to give information on the history and development of gullies and channel enlargement. From these studies the total annual sediment yield to the multipurpose sites was calculated.

Geologic Investigations

Preliminary geologic investigations were made at both planned structure locations. The investigation consisted of a study of the geological formation and conditions that would physically affect the location and construction of the structures. Observations and notations were made as to the kinds of rocks, general attitude of beddings, condition of abutments, ground water table, and description, amount, and location of borrow material.

A semidetailed geologic investigation, using a Damco rig and power auger, was made on site 1. This investigation was made along the centerline of the dam, the principal spillway, and in the emergency spillway area to determine the physical factors that would affect cost of the structure. The results indicate the cutoff trench needs to be extended to shale beneath the Terrace deposits, the sand and gravel pit, and the stream channel. A foundation or toe drain will be needed for seepage from the coarse sand layers. The borrow material from the emergency spillway and sediment pool areas is suitable for use in embankment. Little or no rock excavation will be encountered in the emergency spillway area at the present location.

Both proposed sites are located on the Wichita Formation, which consists in this area of a red silty shale, capped by a gray, coarse-grained sandstone bed. There is a deposit of sand and gravel that extends along the stream channels. There will be some rock excavation required on site 2. Both sites have adequate borrow material, and the water table is low enough that it should not present any problems. Further core drilling and laboratory testing of samples will be required prior to final design and construction.

Geologic problems related to construction were carefully analyzed in arriving at estimated construction costs. All the geologic conditions on each site are described on Form SCS-375, Preliminary Geologic Investigation of Dam Sites. These are on file as part of the work plan substantiating data.

Economic Investigations

Floodwater Damage Reduction and Enhancement Benefits

Damage schedules covering approximately 20 percent of the flood plain were obtained from landowners and operators in the area. These schedules covered land use, crop distribution, yield data, and historical information on flooding and flood damages.

The flood plain below structure location was considered as one evaluation reach, and land use was mapped in the field. Estimates of present normal flood-free yields were based on data obtained from schedules, supplemented by information supplied by other agricultural workers in the area and data from secondary sources.

Crop yields were projected from trends in yields by the better farmers in the vicinity. Land use was projected in accordance with optimum return from use of resources. Adjusted normalized prices were used.

Analysis of the information contained in the schedules and supplemental data from other similar watersheds formed the basis for determining damage rates for depth and season of flooding. The cost of harvesting and other expenses saved were deducted from the gross value of the damage in the calculation of crop and pasture damages.

Damage rates to other agricultural property, such as fences, farm buildings, equipment, and livestock, were estimated from analysis of schedules, using costs prevailing in the area, correlated with sizes of floods. Damage rates for nonagricultural property, such as roads and bridges, were determined by the same method as for other agricultural properties.

The economic evaluation of floodwater damages was made by the computer program for project formulation, using the frequency method.

The monetary value of the physical damage to the flood plain from sediment and scour was based on the value of production lost. The estimate took into account the lag in recovery of productivity and the cost of farm operations to speed recovery. The straight-line evaluation method, described in Chapter 5 of the Economics Guide, was used in making these evaluations.

Floodwater, sediment, and scour damages were calculated under conditions without the project and those which will prevail after the installation of the project. The difference between the damage with the installation of the project and that without its installation, constitutes the benefits creditable to the project.

Indirect damages to agricultural enterprises involve extra farming expense, extra cost of buying feed for livestock, additional travel time due to rerouting of school, mail, and milk routes, and the loss of income due to inability to market farm products at the optimum time. These were estimated at 10 percent of direct damages.

Nonagricultural indirect damages include interrupted travel, inconvenience, and expense sustained as a result of interrupted public utility service. Information on this type of damage was obtained from public officials and was estimated to be 10 percent of direct damages.

Land treatment benefits were estimated to be 5 percent of the damage reduction benefits. This estimate was based on a comparison of the watershed with similar watersheds of like cover conditions and Land Resource Area.

Benefits to Municipal Water

A study by the consulting firm employed by Frederick revealed that the development of Deep Red Run-Coffin Creek sites will provide the best quality water at the least cost. The next best source of quality water at an economical rate would be the Mountain Park Reservoir near Snyder proposed by the Bureau of Reclamation. Their study indicated that the cost of water for repayment of the cost of construction of the proposed Mountain Park project would be 16.1 cents per thousand gallons. On a current cost basis, it is estimated that these costs would be increased to 23 cents per thousand gallons. This alternative cost can be used to compare with the cost of storing municipal water in the Deep Red Run-Coffin Creek sites. The yearly cost of purchasing 2.5 mgd of water from Mountain Park Reservoir at 23 cents per thousand gallons would be \$209,875. The amortized cost of 14 miles of pipeline needed to deliver water from the Mountain Park Reservoir to a point that is equal distance from the Deep Red Run project to Frederick, would be another \$88,489 for a total annual cost of \$294,364.

Secondary Benefits

Secondary benefits, the net increase in the value of goods and services generated by the project, will be realized by workers, processors, and business establishments in the trade area. The evaluation of these benefits was limited to those which will occur locally as a result of project installation. Local secondary benefits were estimated to equal: 46 percent of the direct damage reduction benefits adjusted for a 25-percent leakage; 63 percent of recreational benefits adjusted for a 25-percent leakage; and 63 percent of municipal benefits adjusted for a 90-percent leakage.

Recreation

Benefits from incidental recreation were calculated at \$1.00 per recreation day, since assurance was given that sanitary facilities would be provided. An allowance of 25 cents per visitor day was used for associated costs and deducted from the gross value of benefits.

A value of \$1.50 per recreation day was used for determining recreational benefits at multipurpose site 1. The cost of replacement of basic facilities having a shorter life than the water supply development is considered as part of operation and maintenance and is discussed in another part of this plan.

Redevelopment

Tillman, Kiowa, and Comanche counties are not in an area designated by the Secretary of Agriculture under the Economic Redevelopment Act; therefore, redevelopment benefits were not calculated for project justification.

The areas that will be inundated by the sediment and detention pools were excluded from the damage calculations. An estimate was made, however, of the value of production that would be lost in those areas after installation of the project. Local realtors gave assistance in establishing land and easement values. In this analysis, the estimated easement value was found to be greater than production loss in the converted area. Therefore, the easement value was used in economic justification.

Methods and Procedures

Details of the procedures used in the investigation are described in the Economics Guide for Watershed Protection and Flood Prevention, supplemented by tentative guides and instructions.

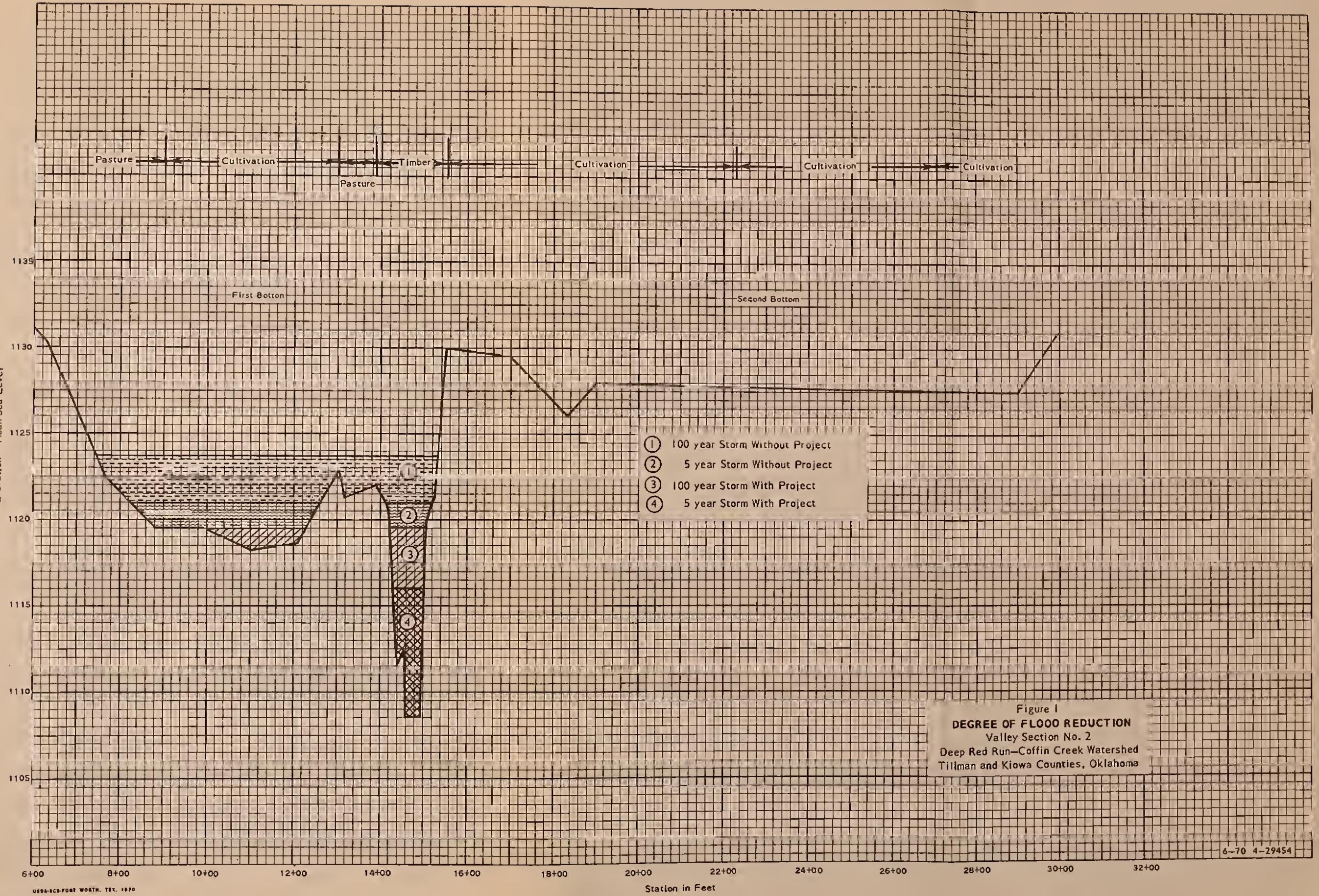
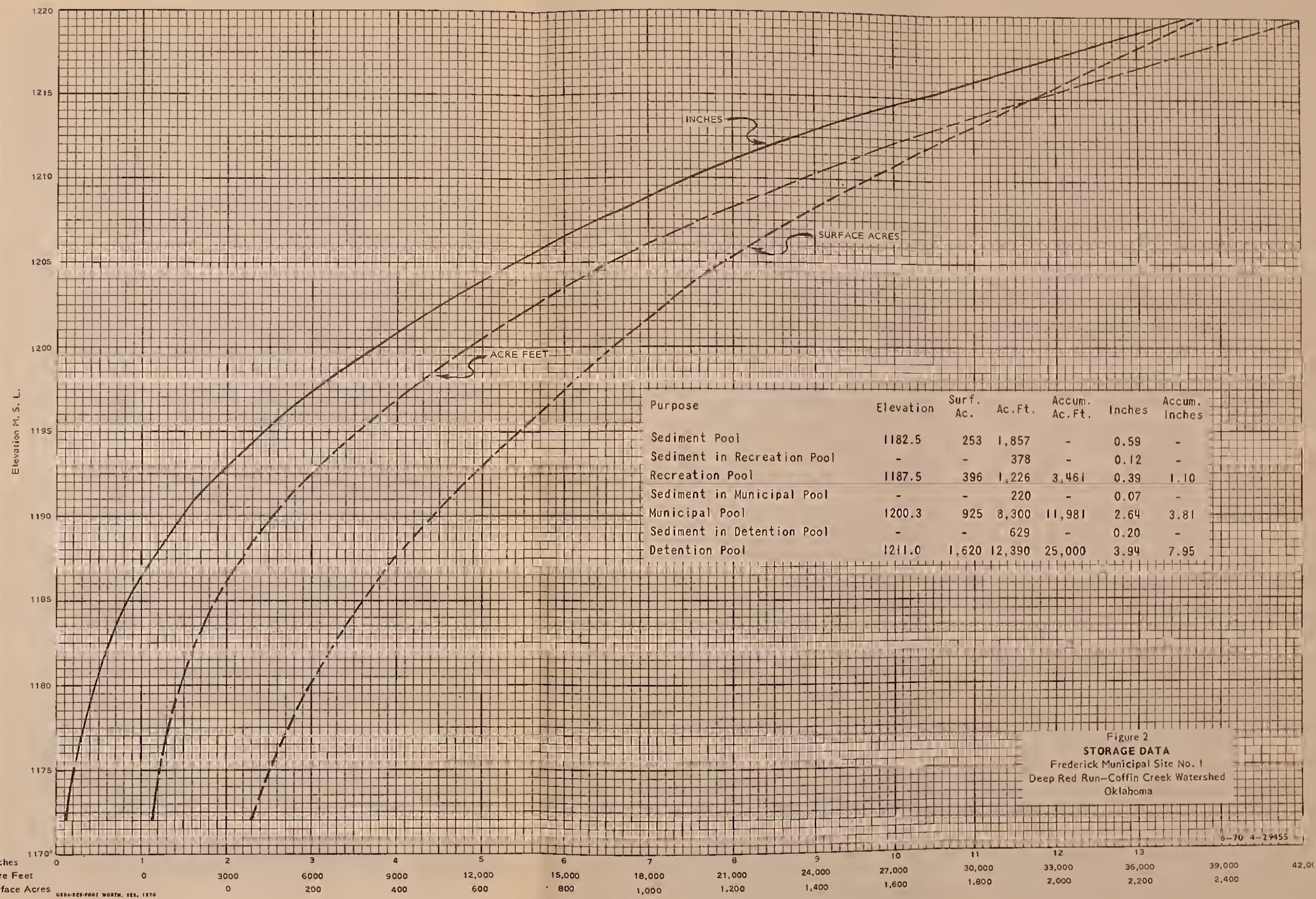
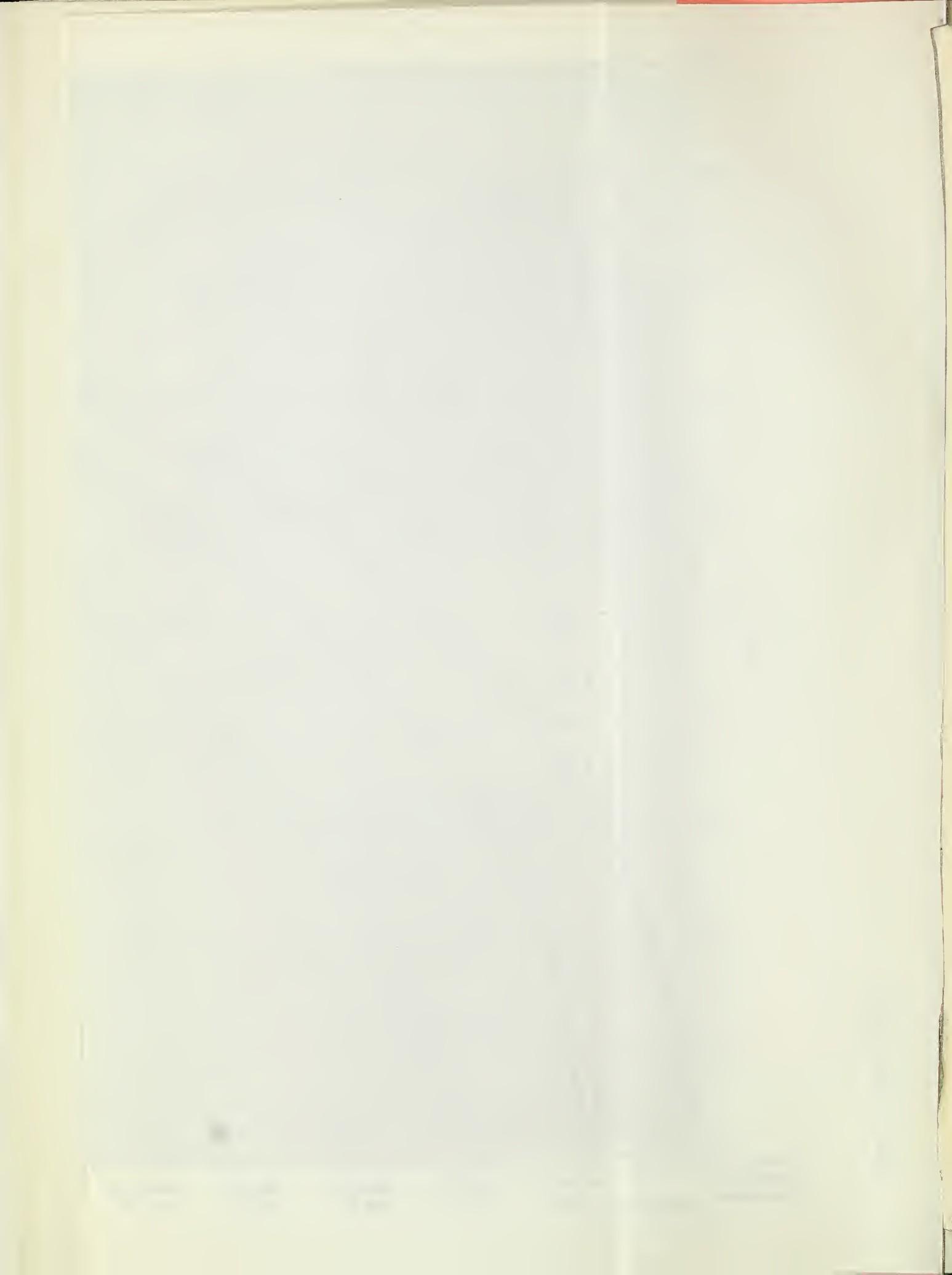


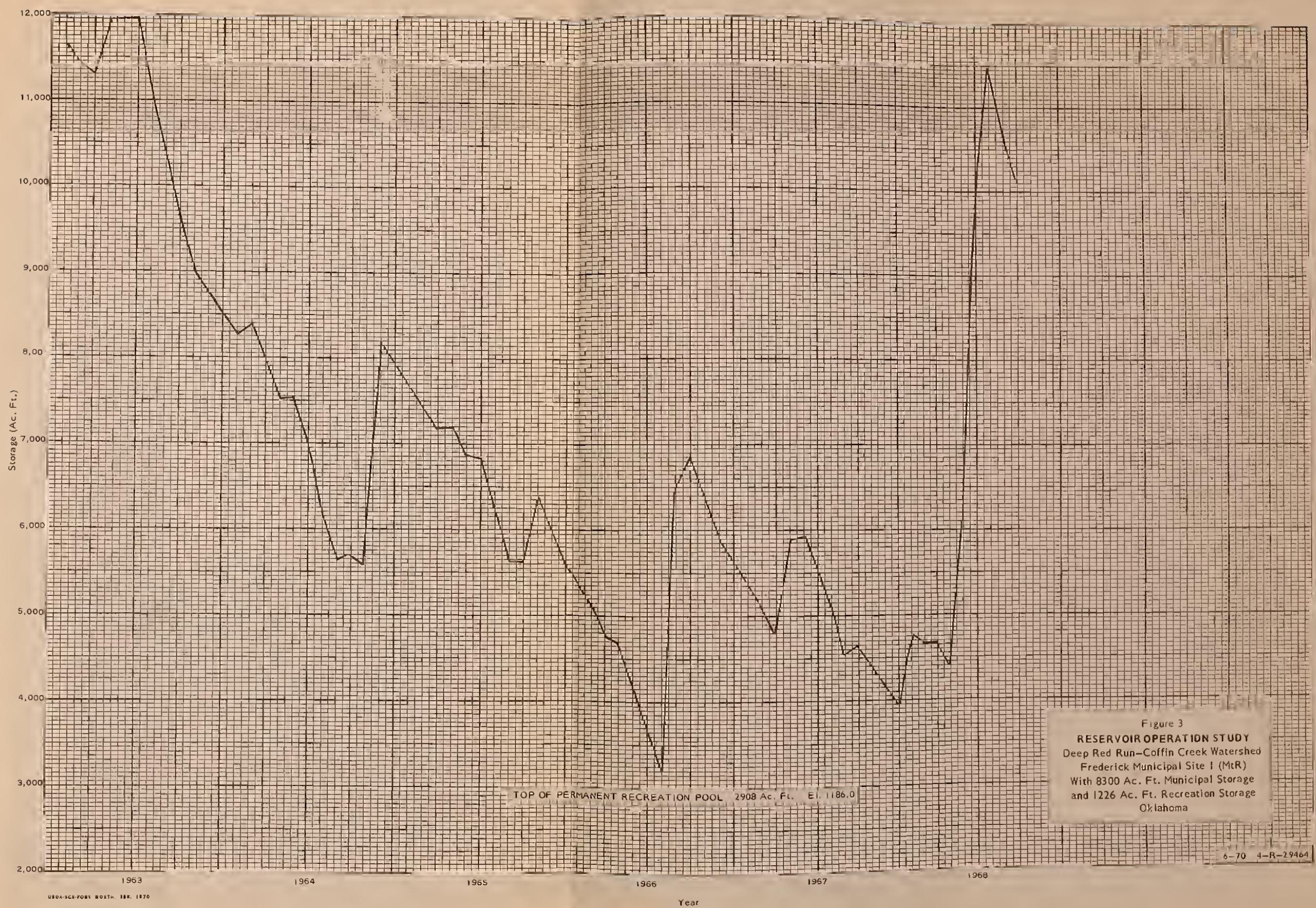
Figure 1
DEGREE OF FLOOD REDUCTION
Valley Section No. 2
Deep Red Run-Coffin Creek Watershed
Tillman and Kiowa Counties, Oklahoma

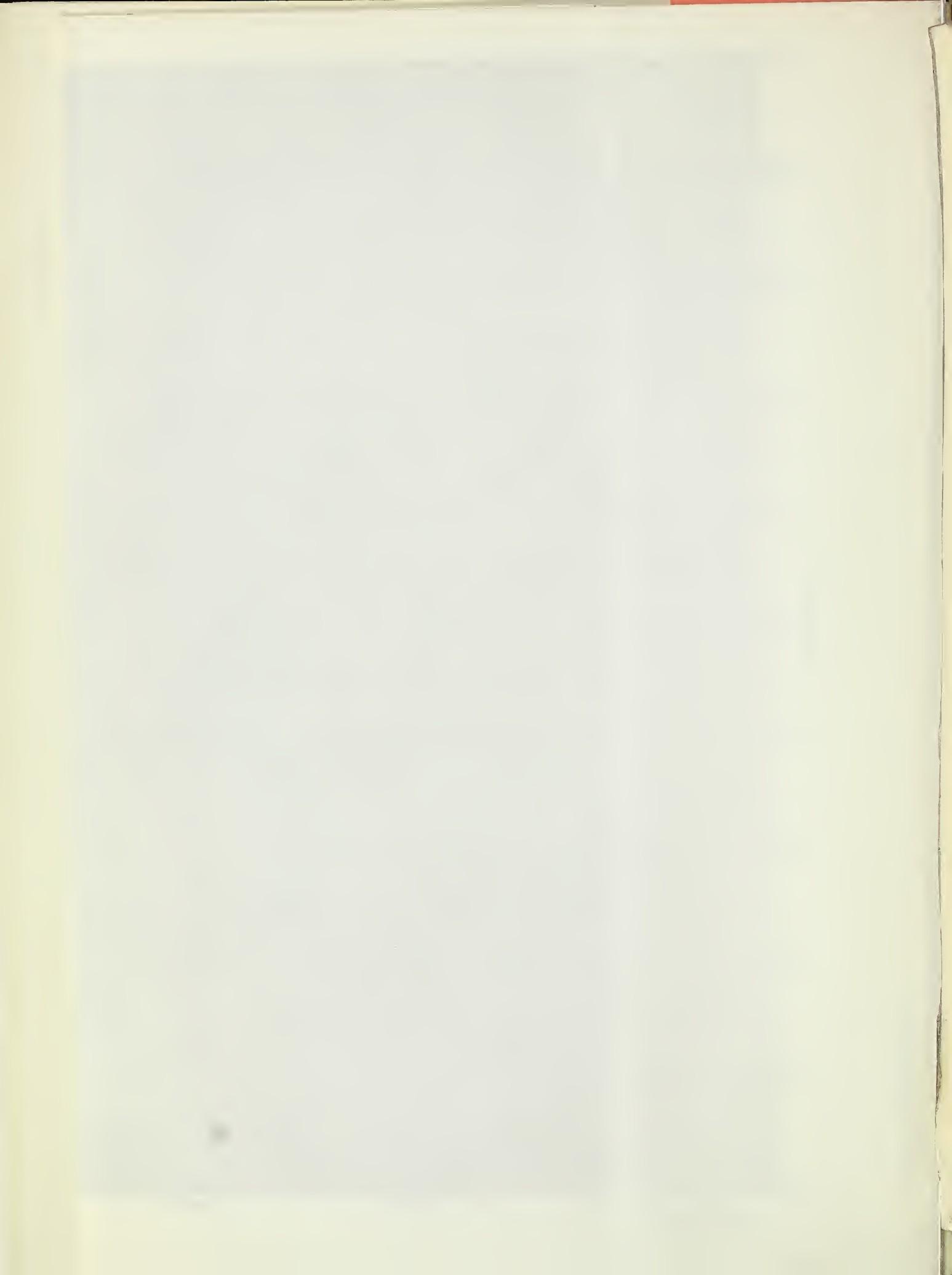
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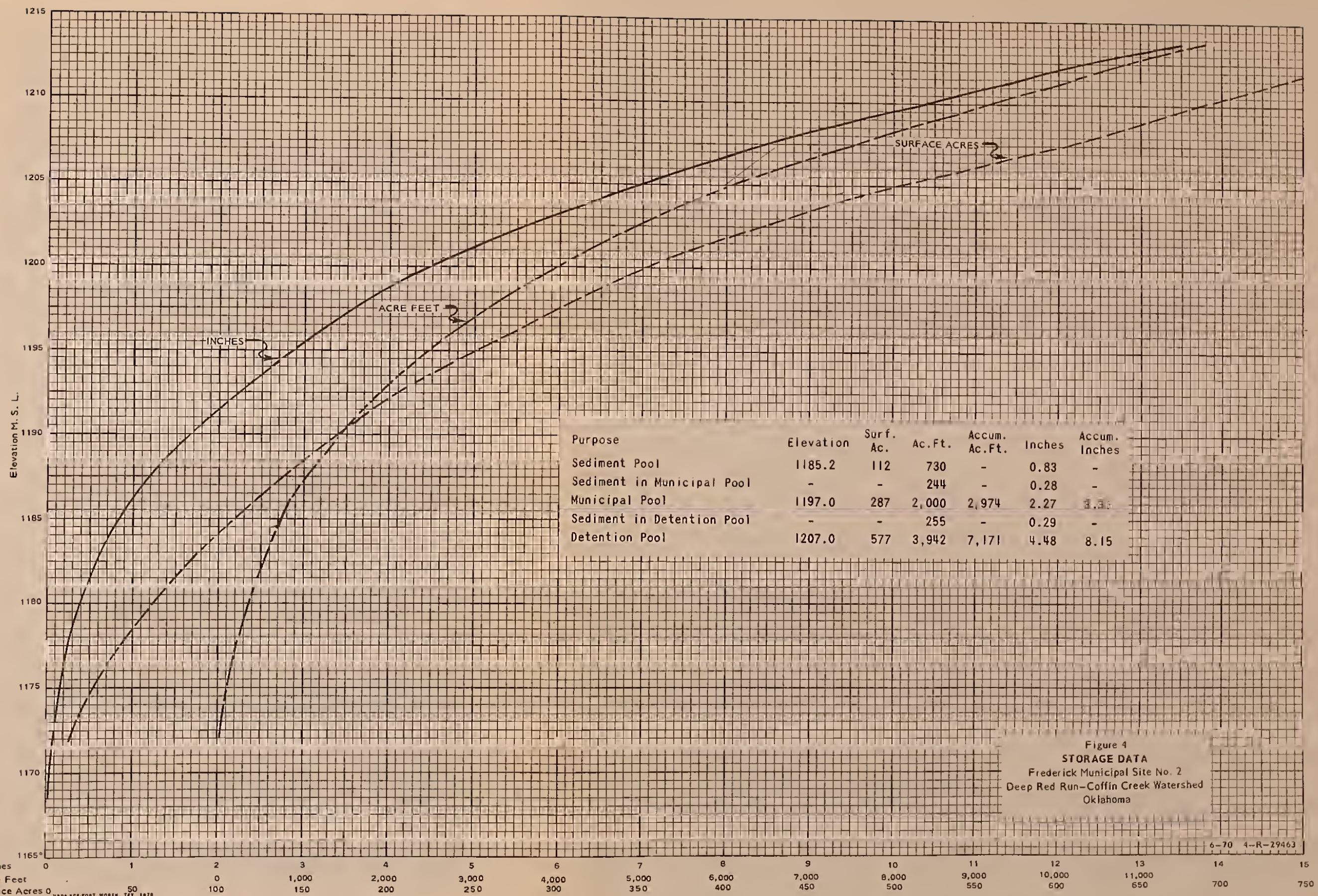


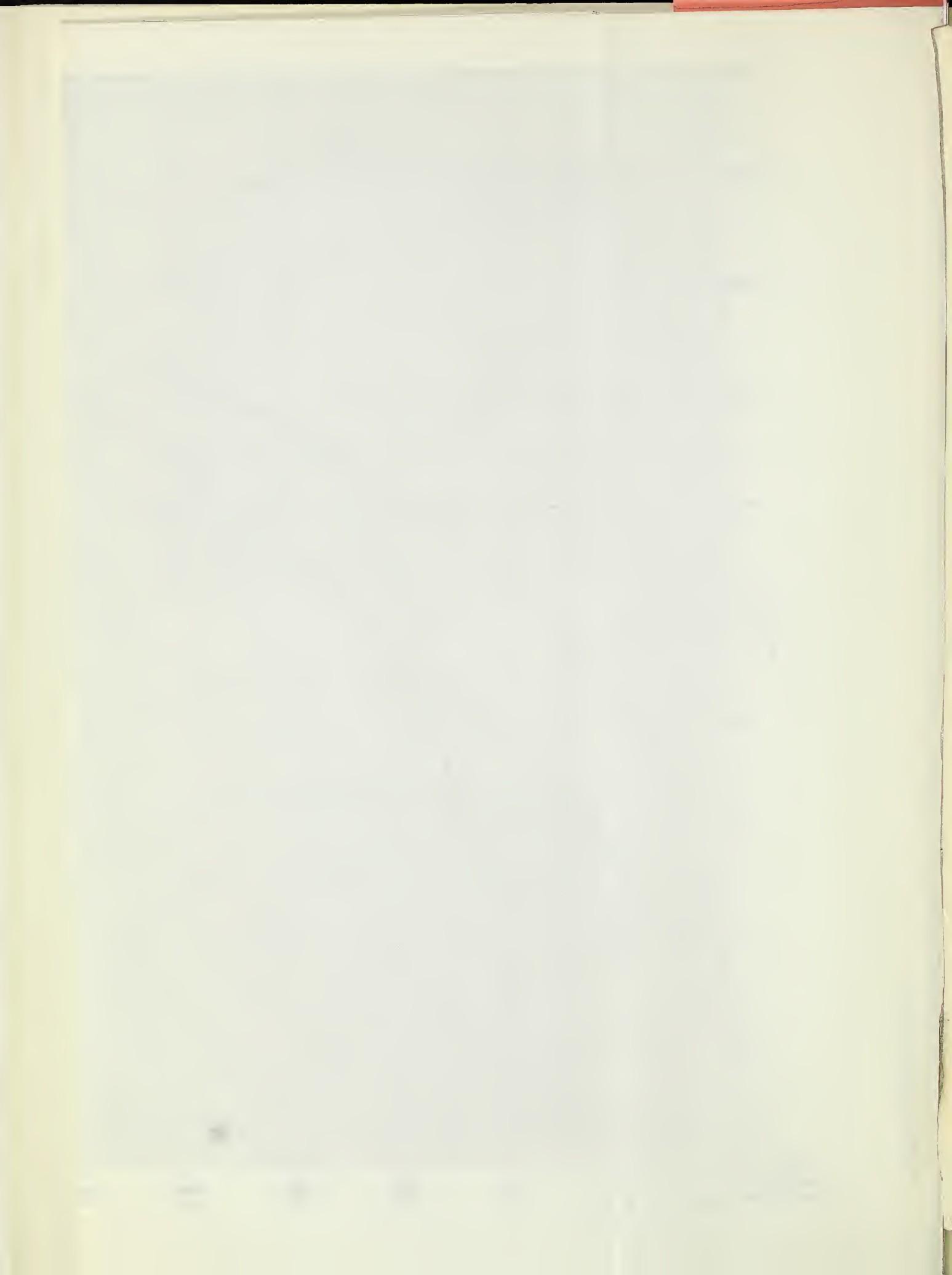












Storage (Ac. Ft.)

3000
2000
1000
0

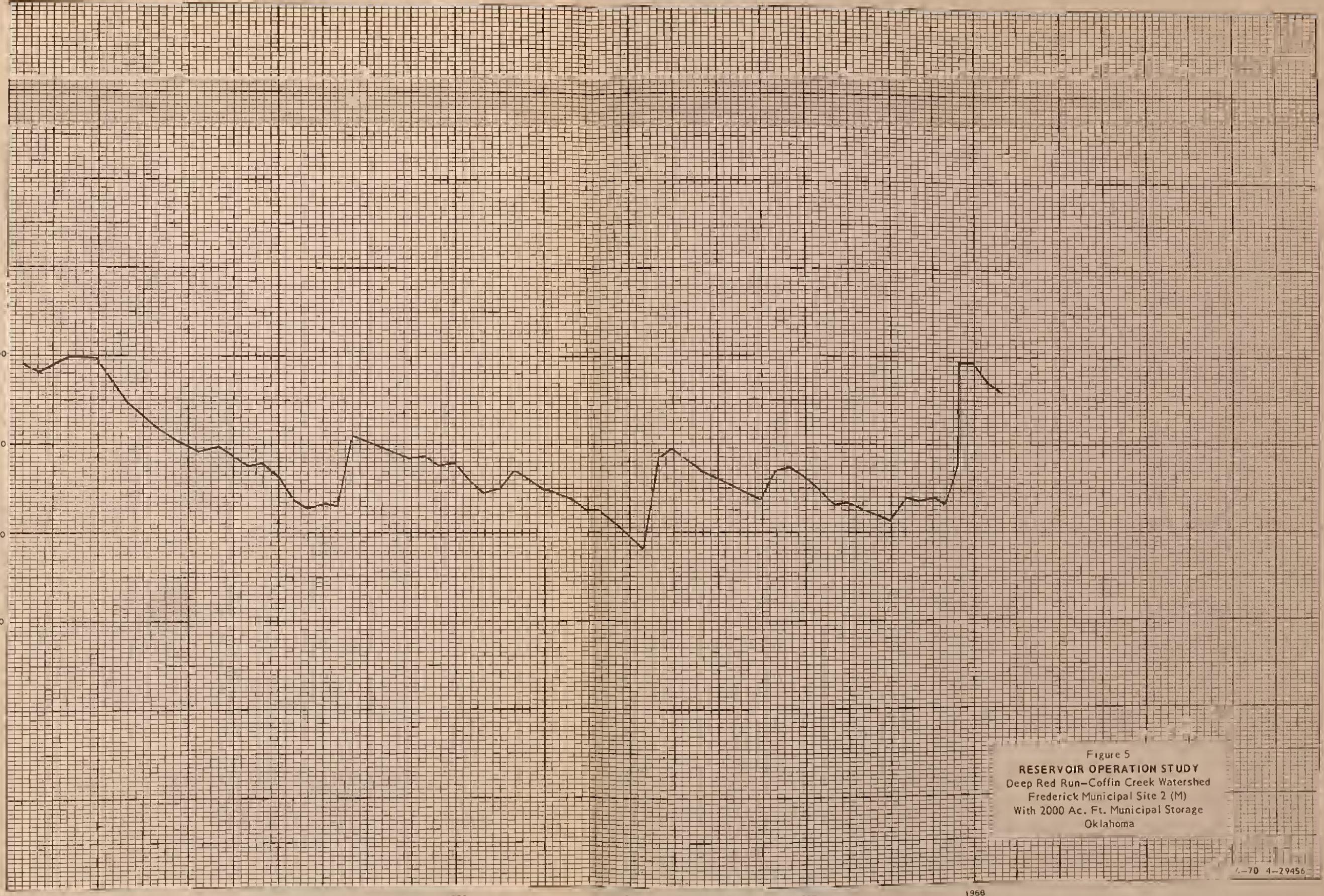
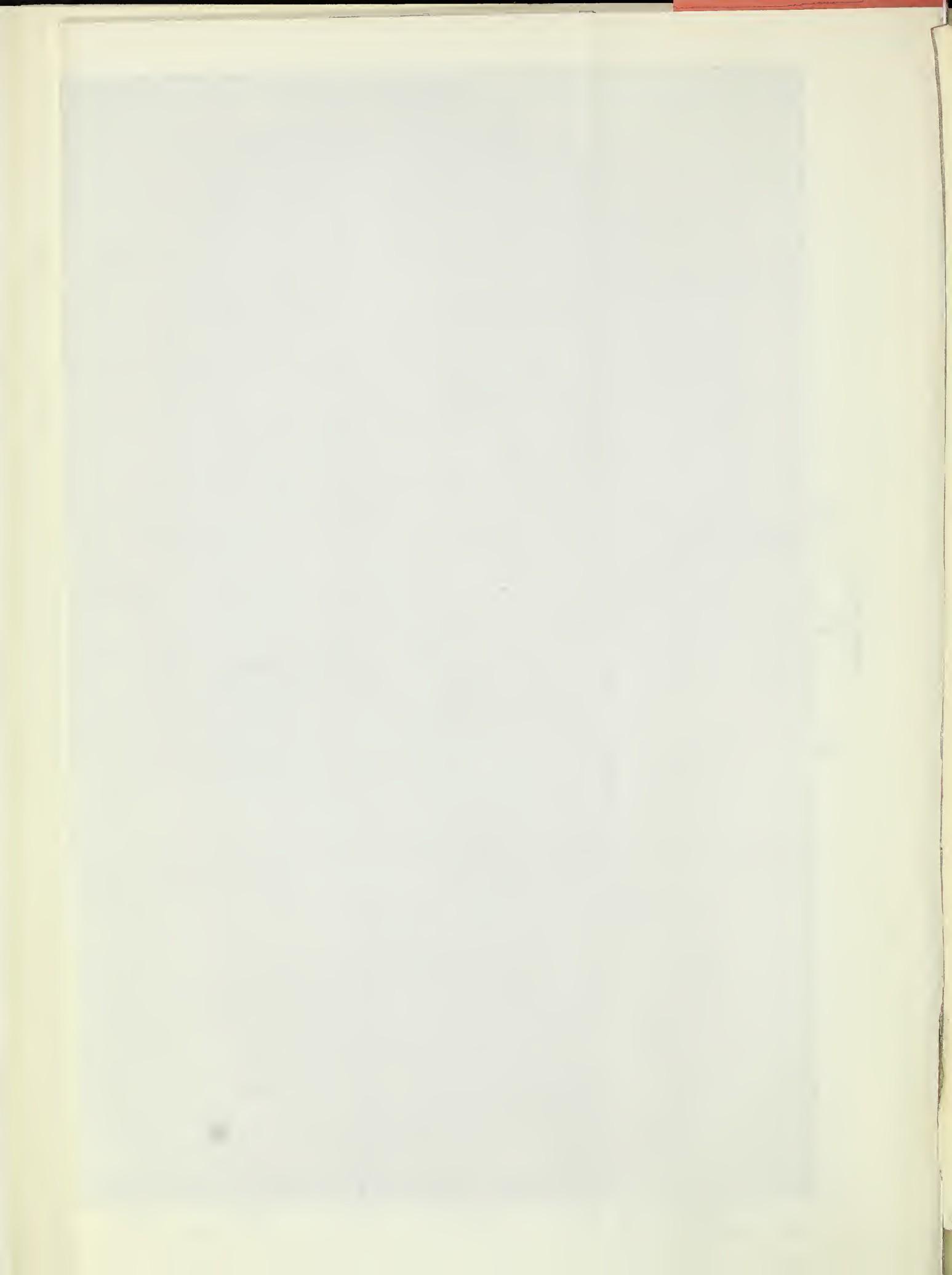


Figure 5
RESERVOIR OPERATION STUDY
Deep Red Run-Coffin Creek Watershed
Frederick Municipal Site 2 (M)
With 2000 Ac. Ft. Municipal Storage
Oklahoma

1-70 4-29456



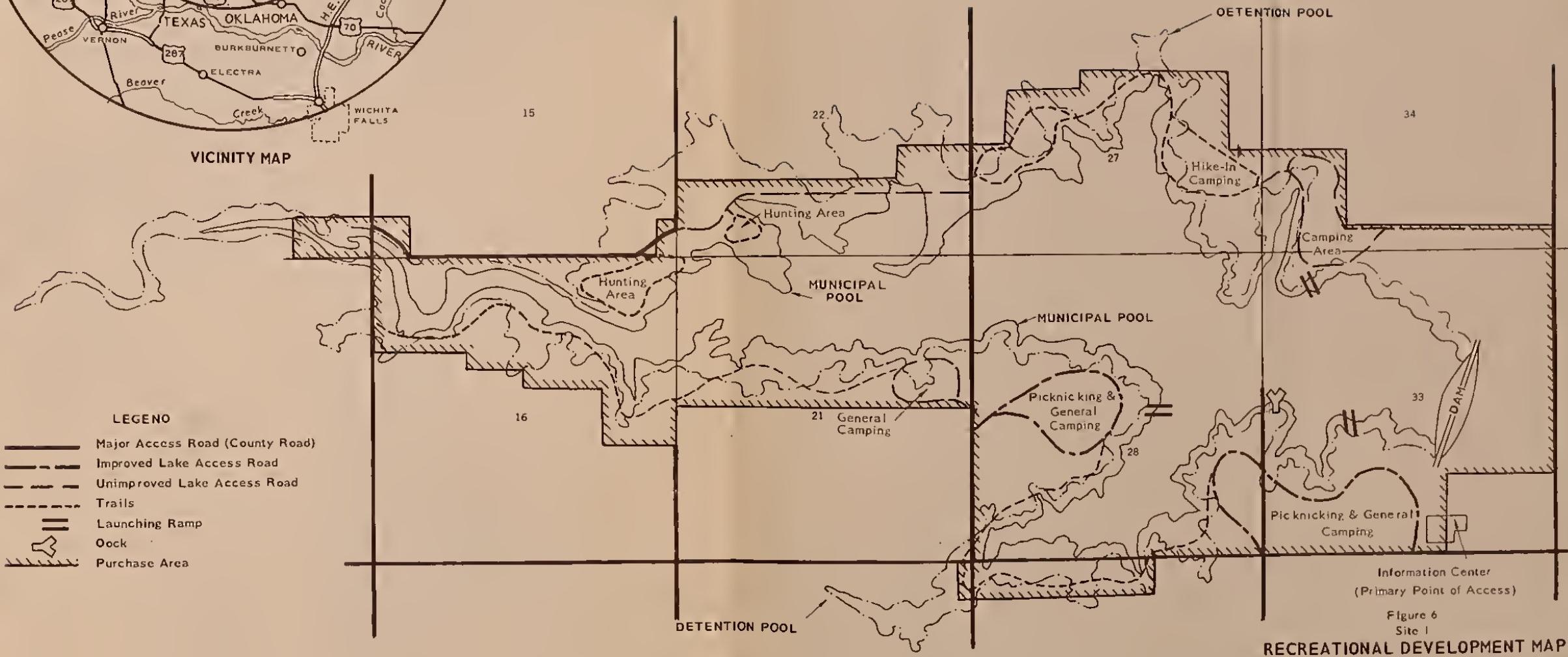
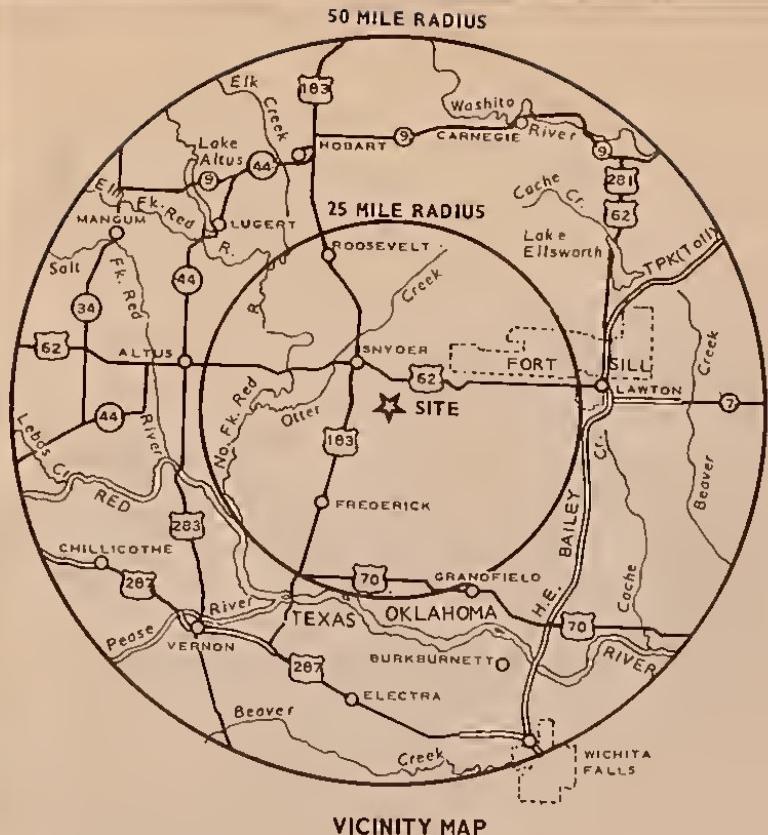
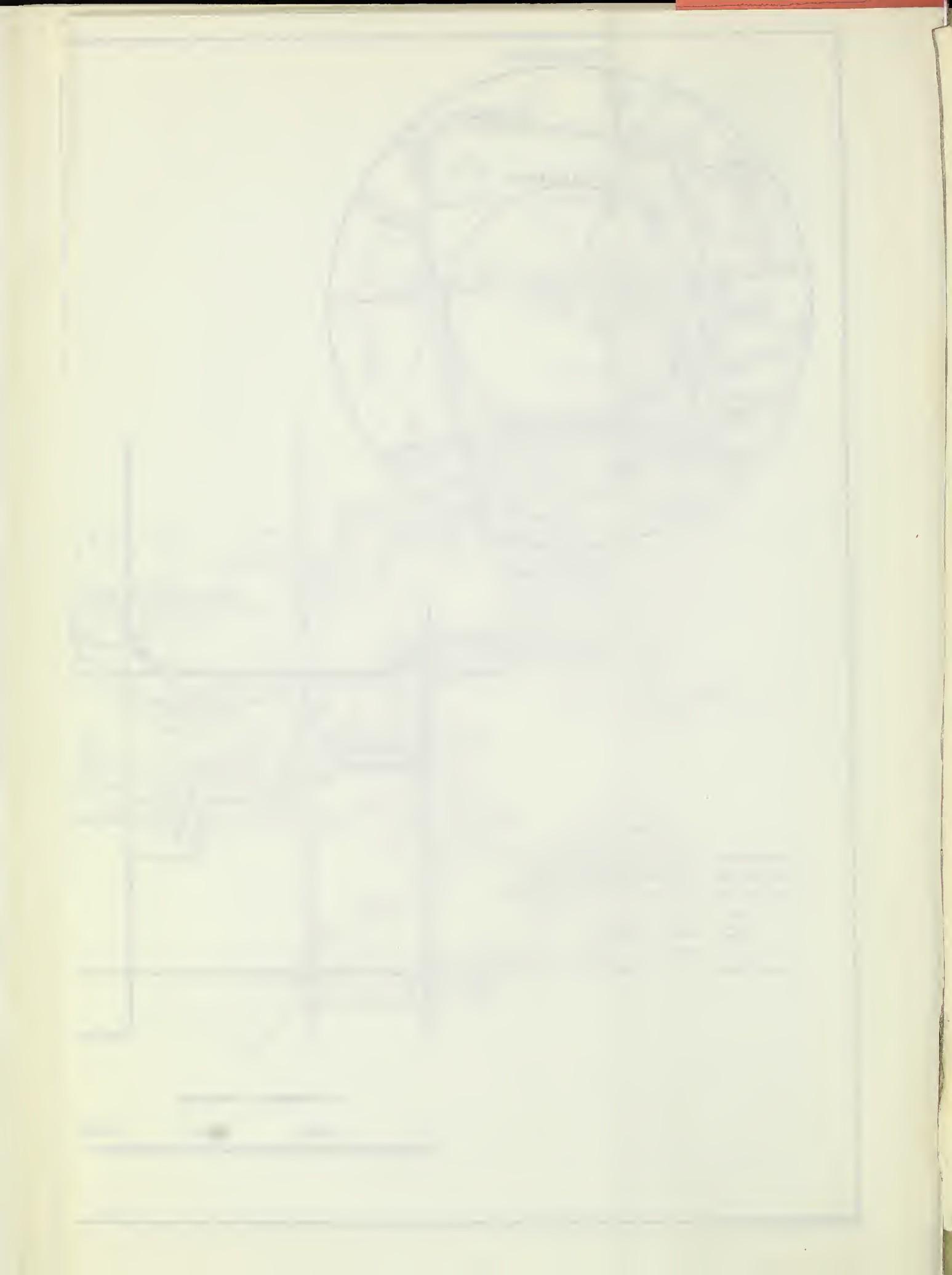


Figure 6
Site I
RECREATIONAL DEVELOPMENT MAP
DEEP RED RUN-CDFFIN CREEK WATERSHED

TILLMAN COUNTY, OKLAHOMA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER, OKLAHOMA

0 2000 4000 6000 Feet



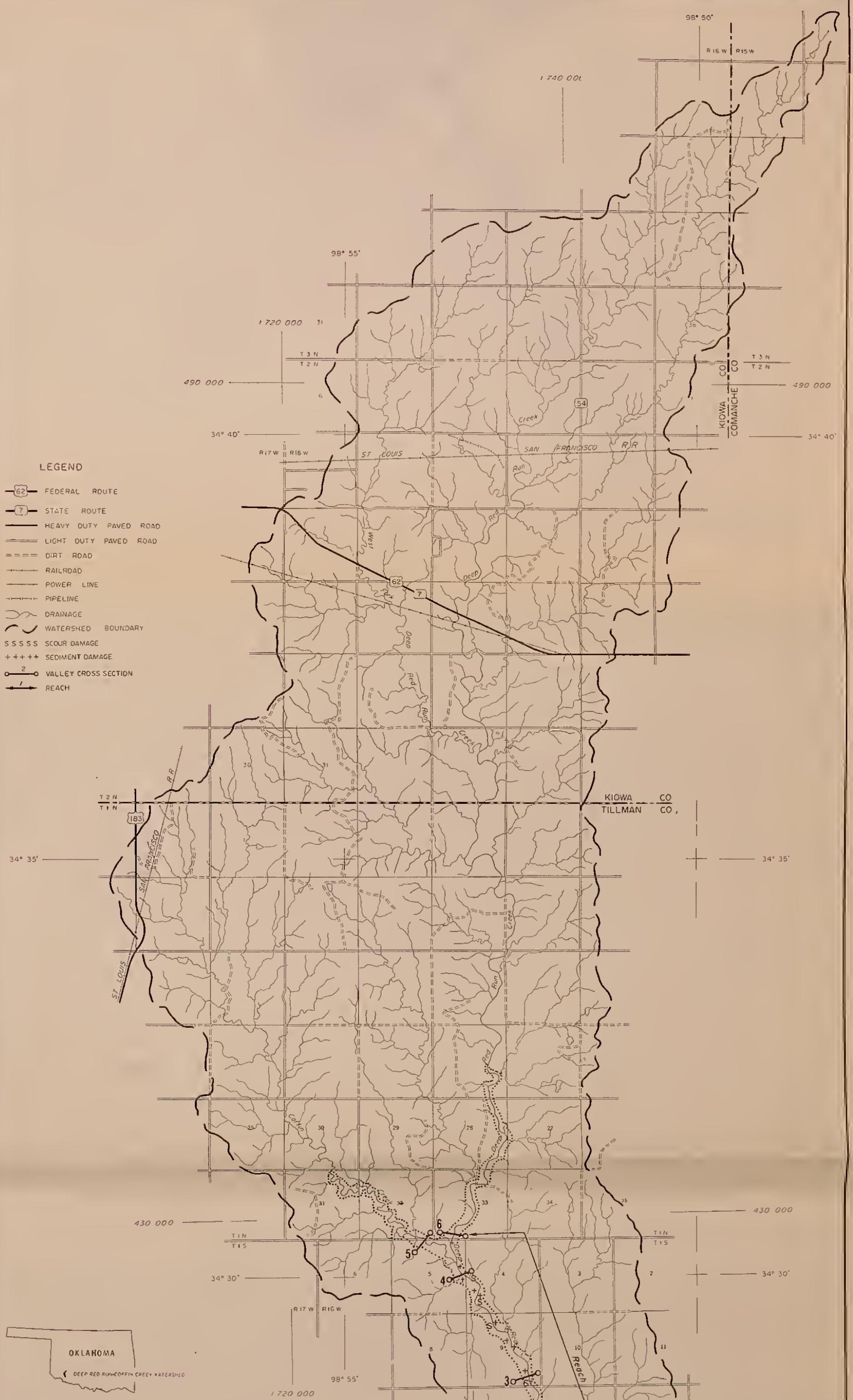


Figure 7
PROBLEM LOCATION MAP
DEEP RED RUN - COFFIN CREEK WATERSHED

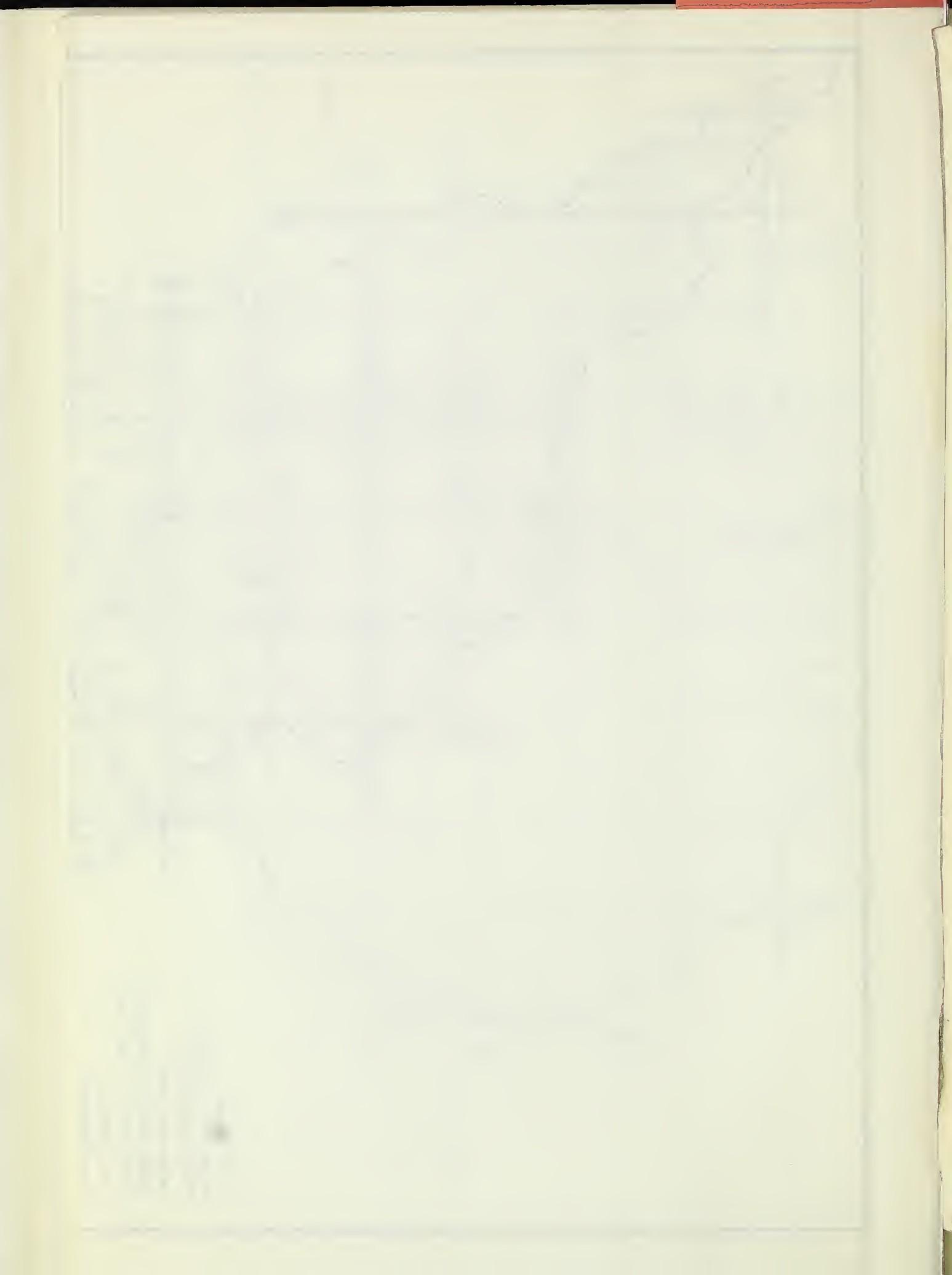
KIOWA, TILLMAN, AND COMANCHE COUNTIES,
OKLAHOMA

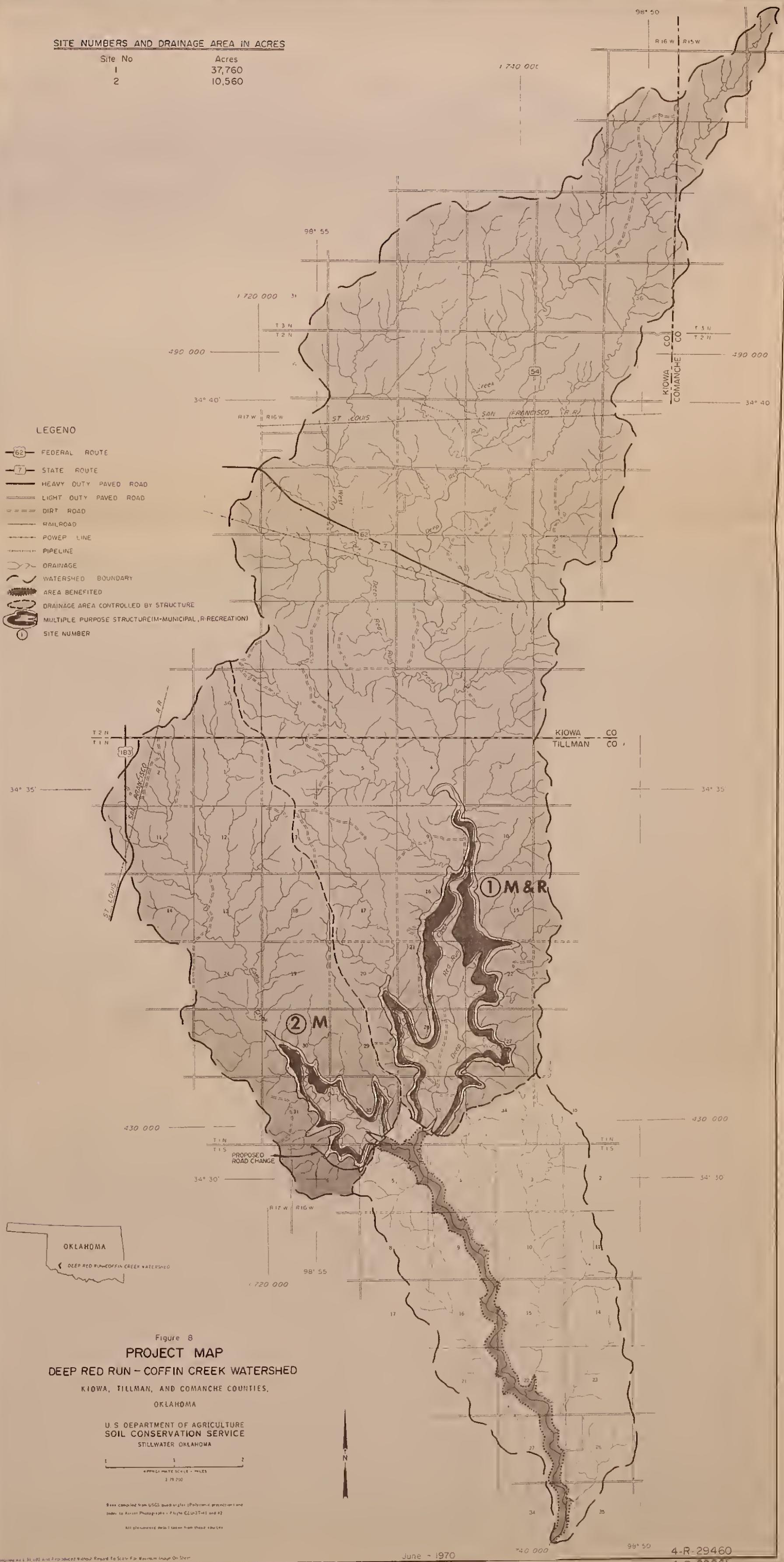
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER, OKLAHOMA

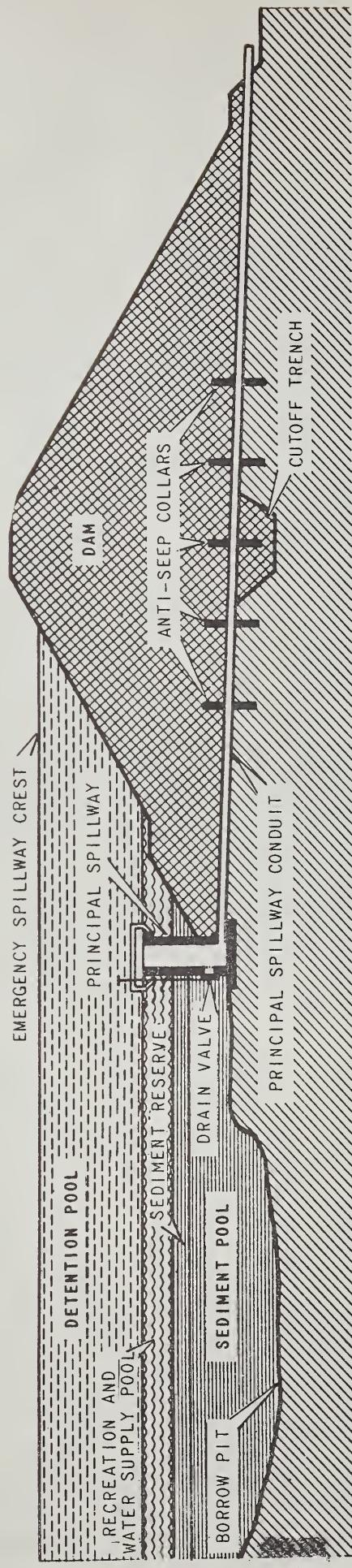
0 1 2
APPROPRIATE SCALE - MILES
179,200

Base compiled from USGS quadrangles [Physiographic province] and
Index to Aerial Photographs - Flights C24N21-41 and 42.

All planimetric detail taken from these sources.







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Plate I
SECTION OF A TYPICAL MULTIPLE-PURPOSE STRUCTURE



